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Re:	Response to Sponsor Ballot on IEEE802.16e/D5a document
Abstract	This document contains suggestions to optimize MOB_PAG-ADV message.
Purpose	This document is for consideration during Sponsor Ballot comments resolution.
Notice	
Release	
Patent Policy and Procedures	

Optimization of the MOB_PAG-ADV message

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1. Problem Statement

The MOB_PAG-ADV message indicates whether an MSS in Idle Mode shall enter network or perform ranging for location update or maintain current Idle Mode. A BS belonging to a paging group shall include all the paging parameters (e.g. MSS MAC Address, Action Code, TLV parameters for paging) for each MSS which is believed to be in Idle Mode within the paging group in the MOB_PAG-ADV message. Therefore, the length of the MOB_PAG-ADV message increases in proportion to the number of MSSs in Idle Mode within a paging group. This may cause considerable bandwidth consumption of the BS and power consumption of the MSSs in Idle Mode. ~~In order to cope with the problem mentioned above, we propose two remedies in this contribution, which are exclusive to each other.~~

~~In Remedy 1, the BS can transmit a compressed form of MOB_PAG-ADV message in which the paging parameters may be omitted in the limited case that the values of the Action Code for all MSSs are set to '00', i.e. 'No Action Required'. Transmitting either the normal MOB_PAG-ADV message or compressed one adequately, the BS can use bandwidth efficiently and make the MSS update its availability in Idle Mode.~~

In Remedy 2, 'MAC Hash Skip Threshold' is proposed. Operation using MAC Hash Skip Threshold is given as follows:

- 'MAC Hash Skip Threshold' defines a maximum number of PAG-ADV messages in which a BS (or paging controller) is allowed to skip an MSS's MAC Address Hash.

- The value of 'MAC Hash Skip Threshold' shall be negotiated in DREG-REQ/CMD transaction as a TLV item. (MSS may indicate its preference for information, and BS determines a specific value, like other parameters for Idle Mode such as Paging Cycle, Paging Offset, and so on.)

- BS may not include MAC Hash of a specific MSS in as many successive PAG-ADV messages as 'MAC Hash Skip Threshold'.

- Whenever BS transmits PAG-ADV message not including MAC Hash of an MSS, it shall increase a count value by one.

- BS shall initiate the count value to zero after transmitting PAG-ADV message including MAC Hash of an MSS or RNG-RSP message indicating successful Location Update.

- Whenever MSS receives PAG-ADV message not including its MAC Hash, it shall increase a count value by one. If the MSS receives successive PAG-ADV messages not including its MAC Hash, as many as MAC Hash Skip Threshold, the MSS shall transmit RNG-REQ message for Location Update.

- MSS shall initiate the count value to zero after receiving PAG-ADV message including its MAC Hash or RNG-RSP message indicating confirming its request for location update.

- If 'MAC Hash Skip Threshold' is not negotiated in DREG-REQ/CMD transaction, BS may not include MAC Hash of an MSS with 'No Action Required' in every MOB_PAG-ADV messages.

An operational example is shown in the figure below.

If MAC Hash Skip Threshold =5

RNG-REQ/RSP
for Location Update

MAC
Hash

MAC
Hash

MAC
Hash

0 1 2 3 4 0 1 2 3 0 1 2 3 4 5   0
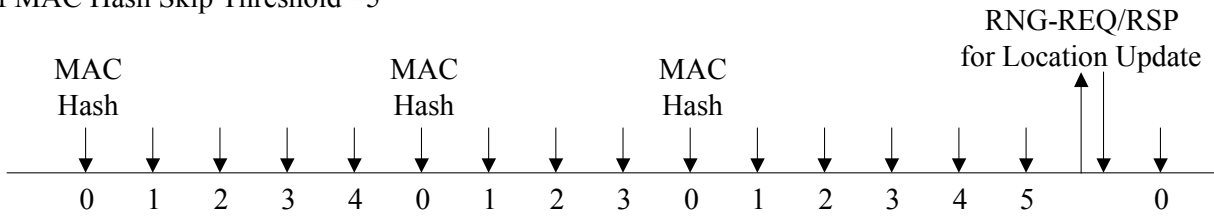
The above two remedies are exclusive to each other.

2. Proposed Text Change

~~**Remedy 1:**~~

~~*[Modify MOB_PAG-ADV message in Page 102-103, Table 106n:]*~~

~~Syntax~~	~~Size~~	~~Notes~~
~~MOB_PAG-ADV_Message_Format() {~~		
~~Management Message Type=62~~	~~8 bits~~	
~~Num_Paging_Group_IDs~~	~~8 bits~~	~~Number of Paging Group IDs in this message~~
~~For (i=0; i<Num_Paging_Group_IDs; i++) {~~		
~~Paging Group ID~~	~~8 bits~~	
~~}~~		
~~Message Type~~	~~1 bit~~	~~0: Normal~~ ~~1: Compressed~~
~~If (Message Type == 0) {~~		
~~Num_MACs~~	~~7 bits~~	~~Number of MSS MAC addresses~~
~~For (j=0; j<Num_MACs; j++) {~~		
~~MSS MAC Address hash~~	~~24 bits~~	~~The hash is obtained by computing a CRC24 on the MSS 48-bit MAC address. The polynomial for the calculation is 0x864CFB~~
~~Action Code~~	~~2 bit~~	~~Paging action instruction to MSS 00=No Action Required~~ ~~01=Perform Ranging to establish location and acknowledge message 10=Enter Network~~ ~~11=reserved~~
~~Reserved~~	~~6 bits~~	
~~}~~		
~~TLV Encoded Information~~	~~variable~~	~~TLV specific~~
~~reserved~~	~~variable~~	~~Padding bits to ensure octet aligned~~

}		
else {		
reserved	7 bits	Padding bits to ensure octet aligned
}		
}		

[Insert the following text in line 50, pp. 103:]

Message Type

Indicates whether or not paging parameters (e.g. MSS MAC Address hash, Action Code, TLV parameters for paging) are included in the MOB_PAG-ADV message. This field shall be set to '1' only when the values of the Action Code for all MSSs are '00'.

0 = Normal type: All of paging parameters shall be included.

1 = Compressed type: All of paging parameters shall be omitted and all MSSs enters Paging Unavailable Interval after the current Paging Listening Interval.

[In 6.3.21.7 BS Broadcast Paging message, insert the following text in Line 4962, pp. 147:]

The BS Broadcast Paging message shall also include an Action Code directing each MSS notified via the inclusion of its MSS MAC Address hash to either:

00: no action required

01: perform Ranging to establish location and acknowledge message

10: perform initial network entry

11: reserved

After transmitting the Broadcast Paging message with Action Code 'Perform Ranging' or 'Enter Network', if the BS does not receive RNG-REQ from the MSS paged until the next Transmission Interval, the BS shall retransmit the Broadcast Paging message. Every time the BS retransmits the Broadcast Paging message, it decreases the predefined 'Paging Retry Count' by one. If the BS does not receive RNG-REQ from the MSS until the 'Paging Retry Count' decreases to zero, the BS determines that the MSS is unavailable.

The Broadcast Paging message may have two types indicated by Message Type; one is Normal type and the other one is Compressed type. The Broadcast Paging message with Normal type (i.e. Message Type=0) shall include all paging parameters (e.g. MSS MAC Address hash, Action Code, TLV parameters for paging) for all MSSs. However, the Broadcast Paging message with Compressed type (i.e. Message Type=1) shall omit all paging parameters. The BS shall transmit the Compressed type of Broadcast Paging message only when Action Code is '00', i.e. 'No Action Required' for all MSSs. At any time, the BS may transmit the Broadcast Paging message with Normal type (i.e. Paging Type=0) to ensure that the message is addressed to the MSSs. If the MSS receives the Compressed type of Broadcast Paging message, it shall act as receiving the Broadcast Paging message in which the value of Action Code is '00', i.e. 'No Action Required'.

Remedy 2:

[Insert the following text in line 4952, pp. 43:]

> **MAC_Hash_Skip_Threshold**
>
> > Maximum number that BS is allowed to skip MSS MAC address hash of an MSS in successive MOB_PAG-ADV messages when the Action Code for the MSS is 00, 'No Action Required'. If BS does not include this TLV item in the message, the BS shall always skip the MAC Address Hash of the MSS with 'No Action Required' in every MOB_PAG-ADV messages.

[Insert the following text in line 18, pp. 45:]

> **The DREG-REQ message may include the following parameters encoded as a TLV parameter:**
>
> **MAC_Hash_Skip_Threshold**
>
> > Maximum number that BS is allowed to skip MSS MAC address hash of an MSS in successive MOB_PAG-ADV messages when the Action Code for the MSS is 00, 'No Action Required'. If BS does not include this TLV item in the message, the BS shall always skip the MAC Address Hash of the MSS with 'No Action Required' in every MOB_PAG-ADV messages.

[Insert the following text in line 40, pp. 146 as a new paragraph:]

The MSS may include 'MAC Hash Skip Threshold' in DREG-REQ with Action Code=0x01 to request to include its MAC Address Hash in MOB_PAG-ADV message, and the BS may approve the request by including 'MAC Hash Skip Threshold' in DREG-CMD message with Action Code=0x05; otherwise, the BS shall always skip MAC Address Hash of the MSS in every MOB_PAG-ADV message in which Action Code for the MSS is 00, 'No Action Required'.

[Insert the following text in line 54, pp. 147:]

The BS shall skip MAC Address Hash of an MSS with Action Code=00, 'No Action Required, except when the BS includes 'MAC Hash Skip Threshold' at the MSS's Idle Mode Initiation. The BS may not include MAC Address Hash of the MSS in as many successive MOB_PAG-ADV messages as MAC Hash Skip Threshold in maximum. Whenever the BS/MSS transmits/receives MOB_PAG-ADV message including MAC Address Hash, the BS/MSS shall initialize 'MAC Hash Skip Threshold'.

[Modify the text line 10-13, pp. 149, as follows:]

6.3.21.9.1 Location Update Conditions

An MSS in Idle mode shall perform a Location Update process operation if any Location Update condition is met. There are three four location update evaluation conditions: Zone Update and, Timer Update, and Power Down Update, and MAC Hash Skip Threshold Update. MSS may also perform Location Update process at will.

[Insert the following text below line 47, pp. 149:]

6.3.21.9.1.4 MAC Hash Skip Threshold Update

The MSS shall perform Location Update process when it does not receive MOB_PAG-ADV message including its MAC address hash as many times as MAC Hash Skip Threshold successively. After successful Location Update, the BS and MSS shall initialize MAC Hash Skip Threshold.

[Change Table in pp. 429, 11.14 DREG-CMD message encodings to include the following row:]

Name	Type	Length	Value
MAC Hash Skip Threshold	mm	1	Maximum number that BS is allowed to skip MSS MAC address hash of an MSS in successive MOB_PAG-ADV messages when the Action Code for the MSS is 00, 'No Action Required'. The unit is the number of MOB_PAG-ADV transmissions. Not including this TLV item, the BS shall always skip the MAC Address Hash of an MSS with 'No Action Required' in every MOB_PAG-ADV messages.

[Change Table in pp. 431, 11.15 DREG-REQ message encodings to include the following row:]

Name	Type	Length	Value
MAC Hash Skip Threshold	nn	1	Maximum number that BS is allowed to skip MSS MAC address hash of an MSS in successive MOB_PAG-ADV messages when the Action Code for the MSS is 00, 'No Action Required'. The unit is the number of MOB_PAG-ADV transmissions.