Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	Enhanced Paging with Assigned Ranging Code
Date Submitted	**2004-06-25**
Source(s)	Hang Zhang, Mo-Han Fong, Peiying Zhu, Wen Tong Nortel Networks 3500 Carling Avenue, Ottawa Ontario, Canada K2H 8E9 mhfong@nortelnetworks.com Voice: +1-613-765-8983 Fax: +1-613-765-6717
Re:	IEEE P802.16e/D3-2004
Abstract	This contribution proposes enhanced paging by assigning a ranging code
Purpose	Review and Adopt the suggested changes into P802.16e/D3
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1 Introduction

In p802.16e/De, the Idle Mode is an optional mode as described in Section 6.3.21. The BS pages the MSS using MOB_PAG_ADV message which includes the MSS's MAC address hash. After receiving this message, with action code set to '01', the MSS shall perform initial ranging to establish location and acknowledge paging. If the action code is set '10', the MSS shall perform initial ranging and enter the network. The initial ranging includes sending initial ranging code in OFDMA ranging channel, waiting for reply (RNG_RSP or CDMA_Alloc_IE) and retrying if no expected reply is received. The above procedure may introduce long delay due to possible collision and back-off.

The currently defined initial ranging is performed on a randomly chosen Ranging Code within the initial ranging code domain. The access operation is therefore contention based. This is not efficient for the case of paging (MOB_PAG_ADV) with action code of either '01' or '10'. This is because when the BS pages a MSS, the event of response from the MSS is a deterministic event and is fully under the control of the BS. As such, the access operation of initial ranging can be made contention free. Here, we propose to modify the current paging-and-response procedure by assigning a dedicated ranging channel (code) to a MSS at the same time when BS pages a MSS in Idle Mode. In this way, the possible collision and back-off can be completely avoided.

2 Proposed Procedure

The following summarizes the proposed procedure:

- Each BS reserves a small amount of codes based on the loading situation
- When a BS pages a MSS, optionally, a dedicated code may be assigned to the MSS in the MOB-PAG_AVD message
- The MSS, after receives the paging, shall use the assigned code to perform ranging until the MSS receives the CDMA _alloc_IE to obtain a dedicated resource to send RNG_REQ

The following figures show the procedure to support the efficient paging (including waking up an idle MSS and BS initiated Idle MSS location update).

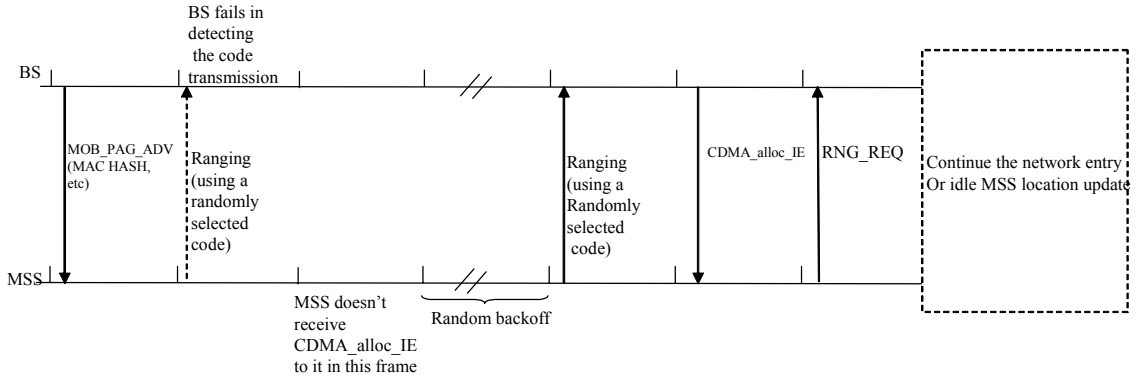
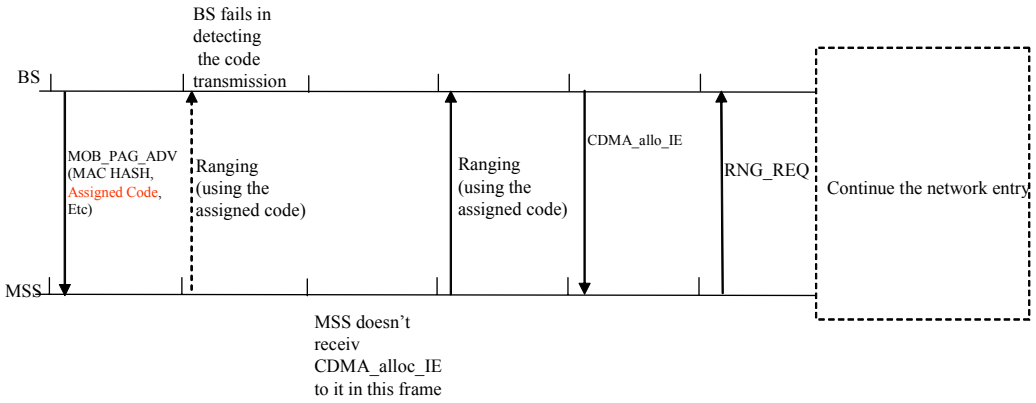


Fig. 1 Current paging procedure.

In current paging procedure, after a MSS receives MOB_PAG_AVD message with its MAC hash included, the MSS will perform normal OFDMA based ranging operation. A back-off is required for collision resolution if a MSS doesn't receive an expected CDMA_alloc_IE with resource assignment.



Fig, 2. The proposed solution.

By implementing the proposed enhancement, the paging/response procedure can be accelerated since the delay caused by random back-off can be completely avoided. At the same time, by using the assigned code, possibility of causing collision to other MSSs who are performing ranging will be reduced.

3 Proposed Text Changes

The following modification is based on p802.16e/D3.

[Modify Table 92I – BS Broadcast Paging (MOB_PAG_ADV) message format by adding the assigned ranging channel index and code index.]

Table 92I – BS Broadcast Paging (MOB_PAG-ADV) message format

Syntax	Size	Notes
MOB_PAG_ADV_Message_Format() {		
Management Message Type	8 bits	
Num_Paging_Group_IDs	8 bits	
For (i=0;i< Num_Paging_Group_IDs;i++) {		
Paging_Group_ID	8 bits	
}		
For (j=0;j< Num_MACs;j++) {		
MSS MAC Address hash	24 bits	
Action Code	2 bits	Paging action instruction to MSS 00 = No Action Required 01 = Perform Ranging to establish location and acknowledge message 10 = Enter Network 11 = reserved
If (Action Code == 01 || Action Code == 10) {		
Code_assignment_indicator	1 bit	0: dedicated code is not assigned with this paging message when a MSS is paged to perform location update or enter network 1: dedicated code is assigned with this paging message when a MSS is paged to

		perform location update or enter network
If (Code_assignment_indicator == 1) {		
Ranging Code_Index	6 bits	Index of the assigned ranging code
}		
}		
reserved	*variable*	Padding bits to ensure octet aligned
}		

[Modify the following text in section 6.3.21.8.1 to describe enhanced paging procedure]

An MSS shall terminate Idle Mode and re-enter the network if it decodes a BS Broadcast Paging message that contains the MSS own MSS MAC Address hash and an Action Code of 10, enter network. In this case, if a ranging code is assigned to the MSS in the MOB_PAG_AVD message, the MSS shall perform initial ranging using the assigned code in MOB_PAG_ADV. Otherwise, A MSS performs normal network entry. In the event that an MSS decodes a BS Broadcast Paging message that contains the MSS own MSS MAC Address hash and an Action Code of 01, Perform Ranging, the MSS shall conduct and complete Initial Ranging to establish location to the network and acknowledge message decoding. If a ranging code is assigned to the MSS in the MOB_PAG_ADV, the MSS shall perform initial ranging using the assigned ranging code in MOB_PAG_ADV. Otherwise, the MSS shall select one of the ranging in the handover/loction update codes domain to perform ranging. Similarly, the MSS shall conduct and complete Initial Ranging to establish location to the network and acknowledge message decoding in the event that it fails to find the MSS own Paging Group ID in the Broadcast Paging message. In either instance of required Initial Ranging, upon completion of the Ranging procedure the MSS shall assume the Paging Group ID of the Preferred BS.