Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	Soft Handover Procedure	
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Re:	This is a response to a Call for Comments in IEEE802.16e Handover Adhoc	
Abstract	In this contribution, the soft handover mechanism is proposed	
Purpose	Adoption as part of Handover Adhoc recommendation to IEEE802.16e	
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1 Introduction

Soft handover (SHO) in the DL is defined as two or more BSs transmitting the same MAC/PHY PDUs to the MSS at the same time interval such that diversity combining can be performed by the MSS. SHO in the UL is defined as two or more BSs receiving (demodulating, decoding) from the MSS at the same time interval. Diversity combining of the received PHY frames is performed among the BSs.

SHO provides macro-diversity gain which is important in increasing the cell coverage as well as increasing the QoS offering at the cell edge. In addition, in the DL, with soft combining, the inter-cell interference is converted into constructive signal, thus improving the overall SNR.

2 Soft Handover (SHO) Operation

There are several conditions that are required to enable soft handover between MSS and a group of BSs. These conditions are listed below:

- Frames multicast by multiple BSs arrive at the MSS within the prefix interval
- BSs involving in SHO have the same frequency assignment
- BSs involving in SHO have synchronized frame structure
- BSs involving in SHO have level 3 context transfer or sharing
- BSs involving in SHO shall use the same set of CIDs for the connections that are established with the MSS.

The following concepts are introduced to support SHO. The first one is the Active Set. An Active Set is defined as the list of BSs that are in SHO with the MSS. When a new BS is added to the Active Set; the MSS' capabilities, security parameters, service flows and full MAC context information are either transferred from the existing BSs in the Active Set to the new BS, or shared between the existing BSs in the Active Set and the new BS. The Active Set is updated and maintained by both the MSS and the BS through exchanges of MAC management messages.

The second concept is an Anchor BS. An anchor BS, that is the BS with the strongest signal strength, is defined within the Active Set. The MSS monitors the anchor BS for DL control information, i.e. DL_MAP, UL_MAP, FCH, and DL broadcast messages. For unicast messages and traffic, the MSS is in SHO with the BSs in the Active Set. The MSS shall continuously measure the signal strength of the BSs in its Active Set to determine if a switch in the anchor BS is needed. Once the MSS has decided to switch to another anchor BS, the MSS shall initiate the switching using MAC management messages.

2.1 SHO Procedures

Similar call flow, procedures and HO messages exchange as defined in IEEE802.16e/D3 can be used for setting up the Active Set and Anchor BS for SHO. There are some modifications required on the existing HO messages, mainly to indicate whether the HO is a normal inter-BS HO or a SHO.

The MOB-NBR-ADV message should be modified to provide information about neighbor BSs who can be involved in SHO with the Anchor or Serving BS. The MOB-MSSHO-REQ message should be modified to enable a MSS to request for update of its active set, or request for switching to another Anchor BS. The MOB-BSHO-RSP message shall be modified to indicate the recommended Active Set members based on the MOB-MSSHO-REQ request. In the MOB-BSHO-RSP message, a 3-bit temporary BS ID (TEMP_BS_ID) is assigned to each member BS of the recommended Active Set. This TEMP_BS_ID is used by the MSS and the BS to uniquely identify a BS within the Active Set for the purpose of subsequent HO MAC management messages exchange. The use of TEMP_BS_ID will significantly reduce the overhead compared to the 48-bit BS_ID. The MOB-HO-IND message shall also be modified to enable a MSS to indicate its final Active Set decision.

Similarly, the BS can initiate an update of the Active Set by sending MOB-BSHO-REQ message, which needs to be modified to include the recommended Active Set member and assign the TEMP_BS_ID to each of the member. Similarly, the MOB-MSSHO-RSP needs to be modified to include the recommended Active Set member.

To allow the BSs in SHO to use the same set of CIDs, one approach is to share the CID space among BSs. Alternatively, a new set of CIDs can be assigned to the MSS whenever the new BS to be added to the Active Set has a conflict with the existing CIDs allocated to the MSS. In this way, the CID space needs not be shared among BSs.

3 Proposed Text Changes

3.1 HO Message Modification

[*Modify the Neighbor Advertisement (MOB-NBR-ADV) message, to indicate which neighbor BS can be in SHO with the Serving or Anchor BS*]

[*Modify the MSS HO Request (MOB-MSSHO-REQ) message, to indicate the list of recommended BSs for SHO and provide the necessary CINR information of those BS*]

[*Modify the BS HO Response (MOB_BSHO-RSP) message, to indicate the list of recommended BSs for SHO*]

[*Modify the HO indication (MOB-HO-IND) message, to indicate the decided list of BSs for SHO*]

[*Modify the BS HO Request (MOB-BSHO-REQ) message, to indicate the list of recommended BSs for SHO*]

[*Modify the MSS HO Response (MOB-MSSHO-RSP) message, to indicate the list of recommended BSs for SHO and provide the necessary CINR information of those BS*]

3.2 Text change

[*Modify section 6.3.20 to include SHO process description*]