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| Title                        | <b>Overview of the proposal for MS MAC handover procedure in an MR Network</b>  |   |
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| Re:                          | Submitted in response to Call for technical proposals issued by IEEE 802.16j on 2006-12-12  |   |
| Abstract                     | This document provides an overview of the proposal on a MS MAC handover procedure for IEEE 802.16j network systems where both MR-BS and its subordinate RSs in an MR-cell transmit their own broadcast control message such as preamble, FCH, DCD, UCD, DL-MAP and UL-MAP.  |   |
| Purpose                      | This contribution is provided as input for the IEEE 802.16j amendment.  |   |
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## 1. Introduction

In this proposal, we define the MAC handover procedure and corresponding MAC management messages over relay links so that an IEEE 802.16e compliant MS can handover seamlessly within an IEEE 802.16j network.

### 1.1 Terminologies and Definitions used in this contribution

**access station:** The station at the point of direct access into the network for a given MS or RS. An access station can be a BS, RS, or MR-BS.

**serving station:** For any MS, the serving station is the station with which the MS has most recently completed registration at initial entry or during a handover. A serving station can be a BS or MR-BS.

**target access station:** A station which is the primary candidate for MS network access following a handover. The target access station can be an RS, BS, or MR-BS.

**target serving station:** A station which is the primary candidate for MS registration following a handover. The target serving station can be a BS or MR-BS.

**infrastructure station (IS):** A station which is not a subscriber. The infrastructure station can be a BS, MR-BS, or RS.

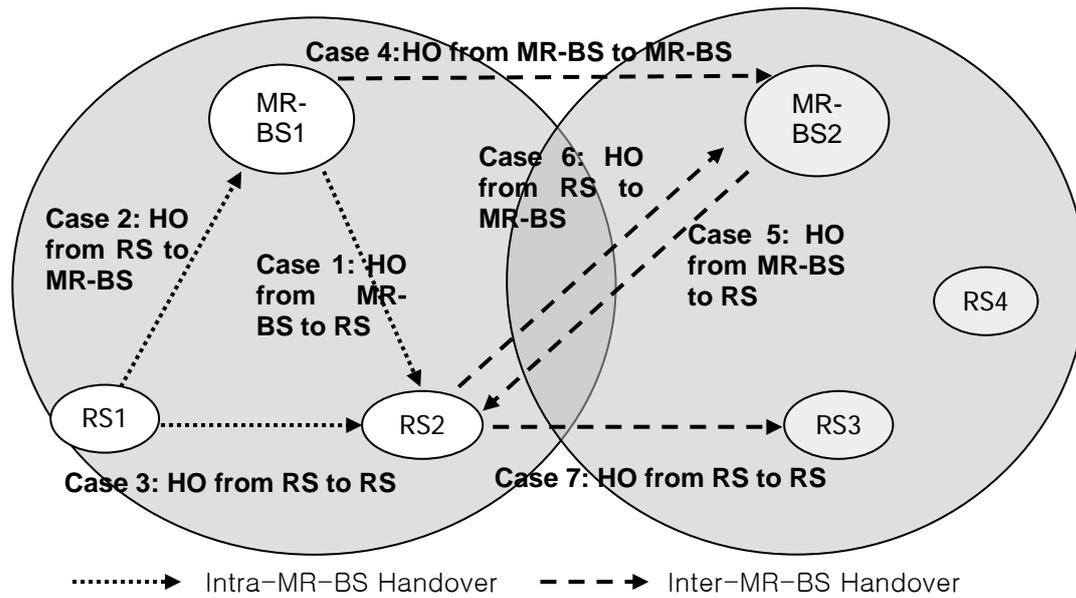
### 1.2 Problem statement

Due to the introduction of RSs into the network infrastructure, seven different handover cases illustrated in Figure 1 are possible to occur in an MR network. The seven cases belong to two main categories of handover: (1) Intra MR-BS handover if the handover is between two RSs controlled by the same MR-BS or between an MR-BS and one of its subordinate RSs; and (2) Inter MR-BS handover if the handover is between two MR-BSs, two RSs each controlled by different MR-BSs, or between an MR-BS and an RS controlled by a different MR-BS.

There can be two to four infrastructure stations directly involved with an MS handover by counting access and serving stations but not including intermediate RSs. Discussions on optional handover features such as MDHO and FBSS in IEEE 802.16e-2005 are not included in this proposal. The signaling between the involved infrastructure stations occurs over the wireless relay links as well as over the wired backbone in an MR-network.

There are only two infrastructure stations involved with an MS handover for Cases 1, 2, and 4. On the other hand, there are three infrastructure stations involved for Cases 3, 5, and 6: (1) Case 3: RS1 is the current access station, RS2 is the target access station, and MR-BS1 is the serving station. MR-BS1 remains as the serving station after the handover. (2) Case 5 - MR-BS2 is the current serving and access station, RS2 is the target access station, and MR-BS1 is the target serving station (3) Case 6- MR-BS1 is the current serving MR-BS, RS2 is the current access station, and MR-BS2 is the target serving and access station. Finally, there are four stations involved for Case 7: MR-BS1 is the current serving station, RS2 is the current access station, MR-BS2 is the target serving station and RS3 is the target access station.

The handover protocol defined in 802.16e can be used to support MS handover between two MR-BSs (case 4). However, all other six cases (i.e., Cases 1, 2, 3, 5, 6, and 7) require new MAC management messages over relay links and corresponding signaling procedure among involved infrastructure stations.



**Figure 1 Seven Handover Cases in an MR network**

Handover procedure can be different depending on the coordination between an MR-BS and its subordinate RSs with regards to broadcast control messages (i.e., Preamble, FCH, DCD, UCD, UL-MAP, DL-MAP). Accordingly, we further classify two different solutions based on this.

- Handover with transparent RSs: Only the MR-BS transmits all the broadcast control messages or RSs in the same MR-Cell transmit the same broadcast control messages with the ones from the MR-BS. Then, the MS considers these stations as the single BS. In this case, Intra MR-BS handover is transparent to the MS.
- Handover with non-transparent RSs: RS can transmit its own Preamble, DCD, UCD, UL-MAP, and DL-MAP. In this case, the MS recognizes an RS as a BS and Intra MR-BS Handover is same as regular 802.16e handover.

This proposal provides an introduction to the subsidiary contributions [1]-[3] aiming at defining the MAC handover procedure for an MR network with non-transparent RSs.

The proposed MAC handover scheme will enable an 802.16e compliant MS to handover seamlessly in an MR network following the MAC handover procedure defined in subclause 6.3.22 of IEEE 802.16e-2005. The focus of this proposal will be on defining a MAC handover procedure with *fixed or nomadic* RS.

The proposed scheme addresses the following aspects of MAC handover procedure based on the structure of subclause 6.3.22 of IEEE 802.16e-2005:

- Handover decision and initiation
- Network entry/re-entry for handover execution with the new access and serving station(s)
- Termination with the current access and serving station(s)

## 2. New MAC management messages over relay links

The following table lists the proposed new MAC management messages for infrastructure stations in an 802.16j network during each phase of the 802.16e MS MAC handover procedure.

**Table 1. New MAC Management messages for infrastructure stations**

| New MAC Management messages | Related MS handover Phase        | Functionality  |
|-----------------------------|----------------------------------|--|
| HO_INFO-REQ,<br>HO_INFO-RSP | Handover decision and initiation | These messages are used to obtain the handover related information of potential target access station(s) over relay links.   |
| MS_INFO-REQ/<br>MS_INFO-RSP | Handover execution               | These messages are used to obtain MS information of old access and serving station which may be needed when the actual handover is performed between the target access station and MS. |
| HO_CPL                      | Handover termination             | This message is used to notify successful handover to the current access and serving station(s) and to the target serving station.   |

### 3. Proposed text change

*[Insert the following as a new subclause 3.xx]*

**3.xx infrastructure station (IS):** A station which is not a subscriber. The infrastructure station can be a BS, MR-BS, or RS.

*[Insert the following in subclause 6.3.22 before subclause 6.3.22.1]*

Due to the introduction of RSs into the network infrastructure, seven different handover cases illustrated in Figure 1 can occur in an MR network. The seven cases belong to two main categories of handover: (1) Intra MR-BS handover if the handover is between two RSs controlled by the same MR-BS or between an MR-BS and one of its subordinate RSs; and (2) Inter MR-BS handover if the handover is between two MR-BSs, two RSs each controlled by different MR-BSs, or between an MR-BS and an RS controlled by a different MR-BS.

There are only two infrastructure stations involved with an MS handover for Cases 1, 2, and 4. On the other hand, there are three infrastructure stations involved for Cases 3, 5, and 6: (1) Case 3: RS1 is the current access station, RS2 is the target access station, and MR-BS1 is the serving station. MR-BS1 remains as the serving station after the handover. (2) Case 5 - MR-BS2 is the current serving and access station, RS2 is the target access station, and MR-BS1 is the target serving station (3) Case 6- MR-BS1 is the current serving MR-BS, RS2 is the current access station, and MR-BS2 is the target serving and access station. Finally, there are four stations involved for Case 7: MR-BS1 is the current serving station, RS2 is the current access station, MR-BS2 is the target serving station and RS3 is the target access station.

The six new cases (i.e., Cases 1, 2, 3, 5, 6, and 7) require signaling among involved RSs and MR-BSs to support handover. This subclause contains procedures for infrastructure stations to support MS handover if the MS is attached to an MR network.

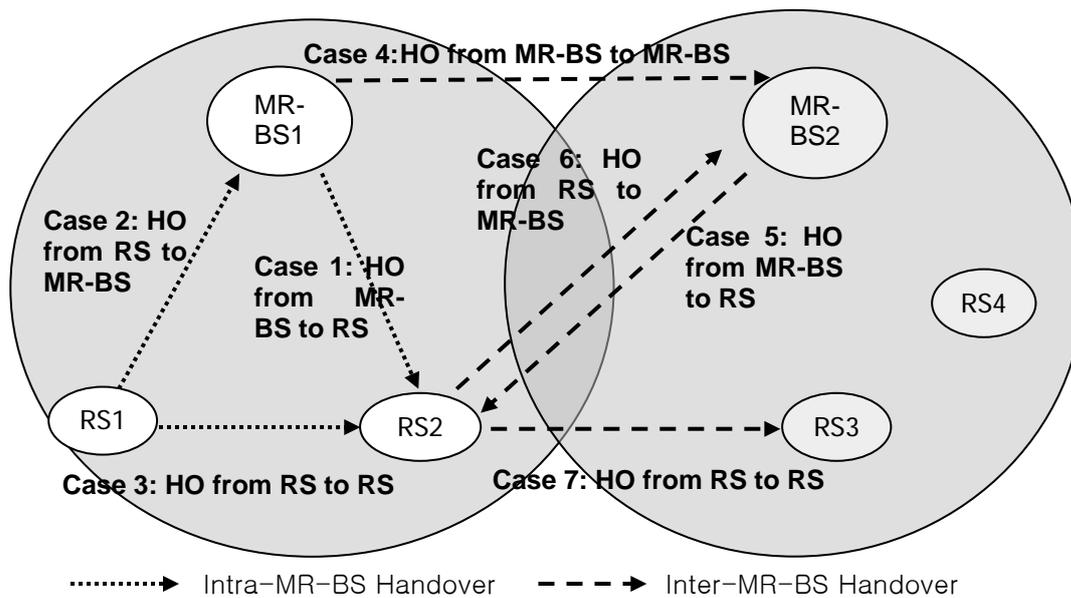


Figure xx Seven Handover Cases in MR networks

References

[1] IEEE C802.16j-07/083, “MS MAC Handover Procedure in an MR Network – Handover Decision and Initiation,” Jan. 2007

[2] IEEE C802.16j-07/084, “MS MAC Handover Procedure in an MR Network – Handover Execution,” Jan. 2007

[3] IEEE C802.16j-07/085, “MS MAC Handover Procedure in an MR Network – Termination,” Jan. 2007