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Re:	This is a response to the call for proposals 80216j-06_034.pdf	
Abstract	This contribution proposes Mobile RS handover procedure.	
Purpose	Add proposed spec changes in P802.16j Baseline Document (IEEE 802.16j-06/026r1)	
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## **MRS Handover**

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Nokia*

Mobile RS (MRS) handover introduces a new mobility issue. The MRS moves along with the MSs attached with it. When a MRS moves from one BS to another, the following two scenarios are possible:

- MRS preamble is re-assigned
- MRS keeps the same preamble

In the former case, all the subordinate MSs of the MRS may need to initiate network re-entry. This contribution is not covering this part. Please refer to [1] and [2].

In the later case, the MR-BS may trigger handover for all the subordinate MSs of the MRS, in order to establish connection. This will increase signaling load. Also, it increases chance of failure as too many MSs are contending for the medium at the same time.

This contribution suggests an efficient handover procedure for MRS for the later case. When MRS moves from source BS to the target BS, it exchanges messages on behalf of all the attached MSs with the source BS for initiating handover. The BS moves all of the MSs together with one set of messages with RS, instead of individual set of handover messages with each MS.

The following figure illustrates the proposed mobile RS handover procedure along with its attached MSs. The figure assumes two MSs attached to an RS.

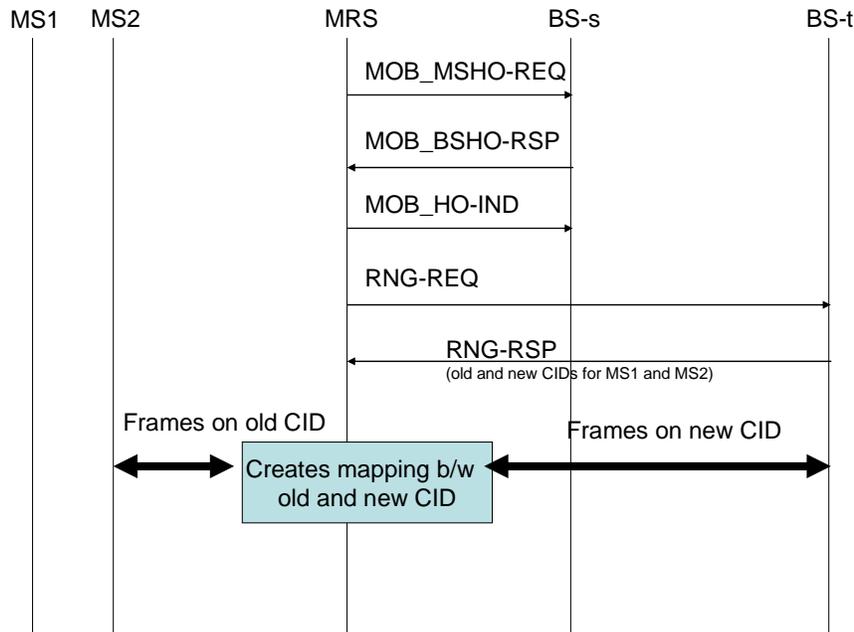


Figure 1: MRS Handover

1. MRS sends MOB\_MSHO-REQ message to the serving BS on its basic CID for initiating handover.
2. The serving BS sends MOB\_BSHO-RSP message to the MRS. The serving BS may send the MAC addresses and CIDs of the MSs under MRS to the target BS over the backbone. It receives HO\_ID and sends HO\_ID in the MOB\_BSHO-RSP message.
3. The MRS sends MOB\_HO-IND message to the serving BS.
4. The MRS performs network re-entry by sending RNG-REQ containing HO\_ID. It also sends serving BS ID and an indication that RNG-REQ is from MRS. If the MRS shares a security association with the target BS, it sends HMAC/CMAC in the message. The MRS may not be able to receive HO\_ID from the serving BS, if the MOB\_BSHO-RSP message is not received by the MRS. The MRS sends the serving BS ID to the target BS. The target BS uses the serving BS ID to contact the serving BS and retrieves the MAC addresses and CIDs of the MSs using backbone procedures.
5. The BS assigns the CIDs for MS1 and MS2, and sends it to MRS in RNG-RSP. MRS creates mapping between old and new CID for each MS. It swaps them for UL/DL traffic and signaling. In this way no signaling procedure is initiated for MS1 and MS2.

During swapping of CID in the MPDU header, MRS may also need to recalculate and replace CRC, which is a minor calculation. CMAC digest is calculated using CID. The MR-BS calculates CMAC on the old CID. Figure 1 shows RS initiated handoff. A BS initiated HO for mobile RS is similar.

## **Advantages**

The proposed MRS handover procedure has the following advantages:

- The handoff is faster, as only one station (RS) is involved instead of multiple MS. Easier and faster to schedule one station for the fast ranging.
- The handoff is bandwidth efficient. There is only one set of signaling message over the RS-BS link for all the MS attached through the RS.
- Less complexity for RS. The contribution introduces minor changes to the existing mobility related messages from 802.16e-2005. Existing messages are used with the addition of few TLVs.

## **Spec Changes**

*Insert new subclause as section 6.3.22.4*

### **6.3.22.4 Mobile RS Handover Process**

The MRS Handoff process hands off all the MS attached to an RS along with the MRS to a target BS. It follows the same main procedures as described for an MS handoff in section 6.3.22.2. The procedures, where certain steps are different, are described in this section.

#### **6.3.22.4.1 HO Decision and Initiation**

When MRS makes a decision for handover, it sends MOB\_MSHO-REQ message on its basic CID to the Serving MR-BS. The MR-BS, knowing that the basic CID belongs to a MRS, sends MOB\_BSHO-RSP message. The serving MR-BS may send the MAC address of the MRS alongwith the MAC addresses and CIDs of the MSs attached to the MRS.

The serving MR-BS initiates handoff for a MRS by sending MOB\_BSHO-REQ message on the MRS basic CID.

#### **6.3.22.4.2 Network Entry/re-Entry**

An MRS shall conduct ranging with target MR-BS for network entry/re-entry during handover. The MRS informs the MR-BS, that the RNG-REQ is from a MRS. The serving MR-BS may

exchanges the backbone messages with the target MR-BS to retrieve the MAC addresses and CIDs of all the MSs attached to the MRS. The details of the backbone messages are beyond the scope of this specification.

The target MR-BS first attempts to keep the same old CID assigned to the MSs. If an old CID from serving MR-BS is already assigned, the target MR-BS assigns a new CID. It sends old and new CID pairs to the MRS in RNG-RSP. The MR-BS creates mapping between old and new CID. It replaces old CID with the new CID in the UL MPDUs. Similarly, it replaces new CID with the old CID in the DL MPDUs.

### 6.3.2.3.5 Ranging request (RNG-REQ) message

*Add the following text at the end:*

The following parameter may be included in the RNG-REQ message when the RS is attempting to perform network entry, re-entry, association or handover:

#### **RS Type TLV (see 11.5)**

### 6.3.2.3.6 Ranging response (RNG-RSP) message

*Add the following text at the end:*

The following parameter may be included in the RNG-RSP message when the MRS is attempting to perform network entry, re-entry, association or handover:

#### **CID List TLV (see 11.5)**

*Insert new subclause (11.6.3):*

#### 11.6.3 CID List

The CID List carries a list of the CIDs of the MSs attached to an MRS. It provides a mapping between old CID (assigned by the old MR-BS) and new CID (assigned by the new MR-BS).

Type	Length	Value
-	Variable	See the following table

Field	Length	Note
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Number of MS	2 bytes	The next two fields will be repeated number of MS times
Old CID	2 bytes	
New CID	2 bytes	

### 11.5 RNG-REQ message encodings

Add the following row in Table 364:

Name	Type (1 byte)	Length	Value (variable-length)
RS Type	-	1	0: Fixed RS 1: Mobile RS 2-255: Reserved

### References

[1] Mobile Relay-Station Preamble Segment Re-Assignment Scheme, C80216j-07\_041.doc; Peter Wang, Adrian Boariu, Shashikant Maheshwari, and Yousuf Saifullah; Nokia

[2] Group Handover on the Mobile RS, C80216j-07\_122.doc, Sungkyung Kim, Sungcheol Chang, and Chulsik Yoon; ETRI