Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Mobile RS Handover**	
Data Submitted	~~16-Jan~~05-March-2007	
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Re:	This is a response to Call for Technical Proposals regarding IEEE Project P802.16j.	
Abstract	The document contains technical proposals for IEEE P802.16j that would provide a handover method on the Mobile RS.	
Purpose	The document is submitted for review by 802.16 Working Group members.	
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Mobile RS Handover

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1. Introduction

The Mobile RS (MRS) is mounted on the vehicle, such as a bus or train, provides a fixed access link to MS riding on the platform. In general, the quality of the link between MR-BS and MRS is better than that of the link between MR-BS and MS. Moreover, the usage of MRS needs small feedback information (that is, CQI reports, BW request, MIMO feedback, etc.), which it can cover entire feedback of several MSs riding on the vehicle. In this usage scenario, the MRS shall endeavor to maintain reliable radio links to the MSs and also the MRS must have the capability of handover.

In MRS operation scenario, we note that the MRS is apt to start handover earlier than the MS. In addition, all MS would start handover procedures almost at the same time as the condition of handover occurs. In addition, the links between MR-BS and MS may be unstable in the handover regions. Therefore, we propose a method of handover for the MRS and the MSs attached with it. Our contributions are able to keep QoS of the ongoing calls and save the radio resources.

2. Proposed Solution

The MRS can perform a handover, which ~~this~~ is similar to the conventional HO procedures as defined in 6.3.22. In this case, MOB_HO related messages can ~~be~~ still be used at both the MRS and the MR-BS with small changes as the MRS fakes an MS. When the MR-BS receives a MOB_HO related message, it can recognize the sender as MRS by parsing a “basic CID” field into the generic MAC header.

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 former case, MRS should change its PHY configuration, such as preamble index, subcarrier-permutation, frame configuration, etc. It will depend on new target MR-BS and co-channel interference due to the RS mobility. In this case, the MRS can operate as non-transparent RS as well as transparent RS. This contribution deals with the former case. While, we can consider that the MRS keeps the same preamble. In this case, [2] suggests an efficient handover procedure for MRS.

This contribution introduces a mobile RS HO process, which enables a MRS to control handover of subordinate MSs. We can assume that the MR-BS and the MRS maintain a list of MSs that are served

through the corresponding relay link. If the target MR-BS decides the MRS to change its preamble after the handover, the Preamble Index TLV can be contained into the MOB_BSHO-REQ/RSP messages [3].

The following figures illustrate the proposed MRS handover procedures along with its attached MSs.

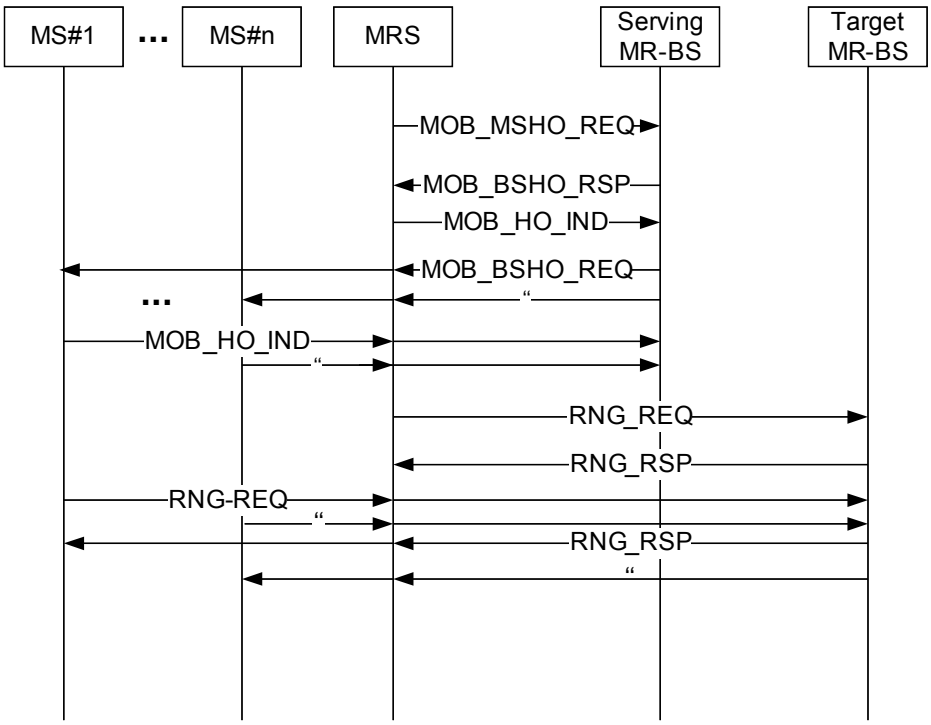

Figure 3. ~~The example of~~ MRS handover ~~in case that the MRS doesn't share security keys for MS with the MR-BS (-~~ MRS-initiated~~)~~

~~While, Figure 3 and Figure 4 show the case that the security keys are distributed only between the MR-BS and the MS. In this case, the MRS just delivers MOB HO-related messages received from the serving MR-BS to its subordinate MSs.~~

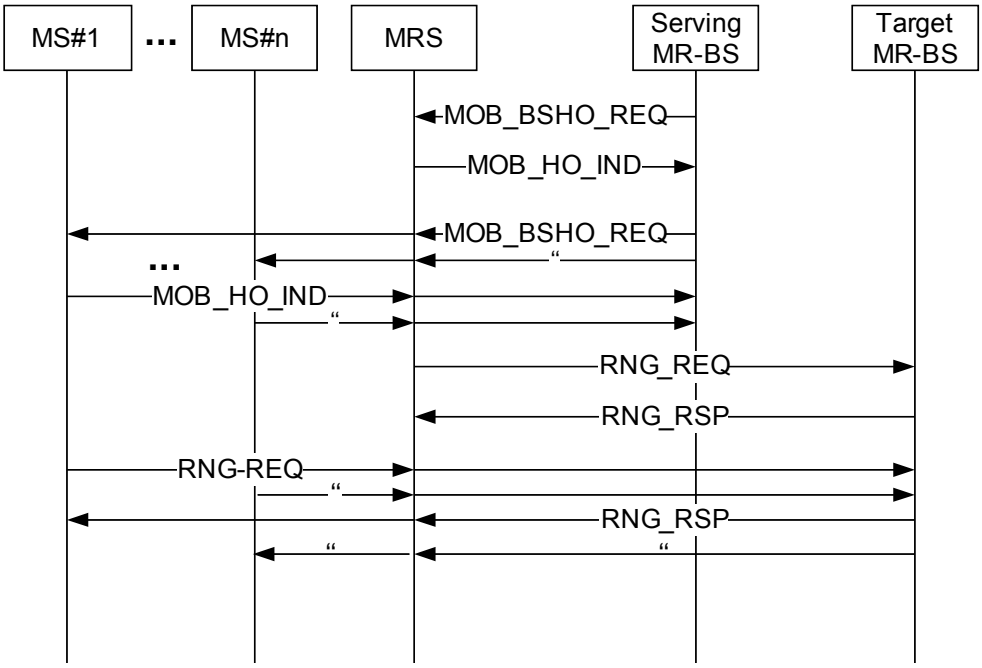

Figure 4. ~~The example of~~ MRS handover ~~in case that the MRS doesn't shares security keys for MS with the MR-BS (~~ MR-BS-initiated~~)~~

Figure 3 shows an example of procedures of a MRS initiating MRS handover. When MOB_MSHO-REQ is sent by a MRS, the MRS may indicate one or more possible target MR-BS. When receiving this message, the MR-BS prepares HO process for the corresponding MSs and sends a MOB_BSHO-RSP message to the MRS with several parameters of service level prediction, HO optimization, action time, HO_ID, etc.

In case that MRS doesn't share the security keys to authenticate MAC management messages of MS with the MR-BS, the serving MR-BS begins HO for each MS. After the all handover request/response handshakes between the serving MR-BS and multiple MSs have completed, the MRS send a MOB_HO-IND message to the serving MR-BS in order to notify the completion of MRS HO and its result indicated at the HO_IND_type fields.

The MR-BS may set "Action Time" for fast handover ranging of the MRS using MOB_BSHO-REQ/RSP messages, which is similar to MS Handover process in 6.3.22.2.

Figure 4 shows an example of procedures of a MR-BS initiating MRS handover. This is similar to the case of MRS initiating.

~~Figure 5 shows the case that the MRS shares the security keys for MS with the MR-BS.~~

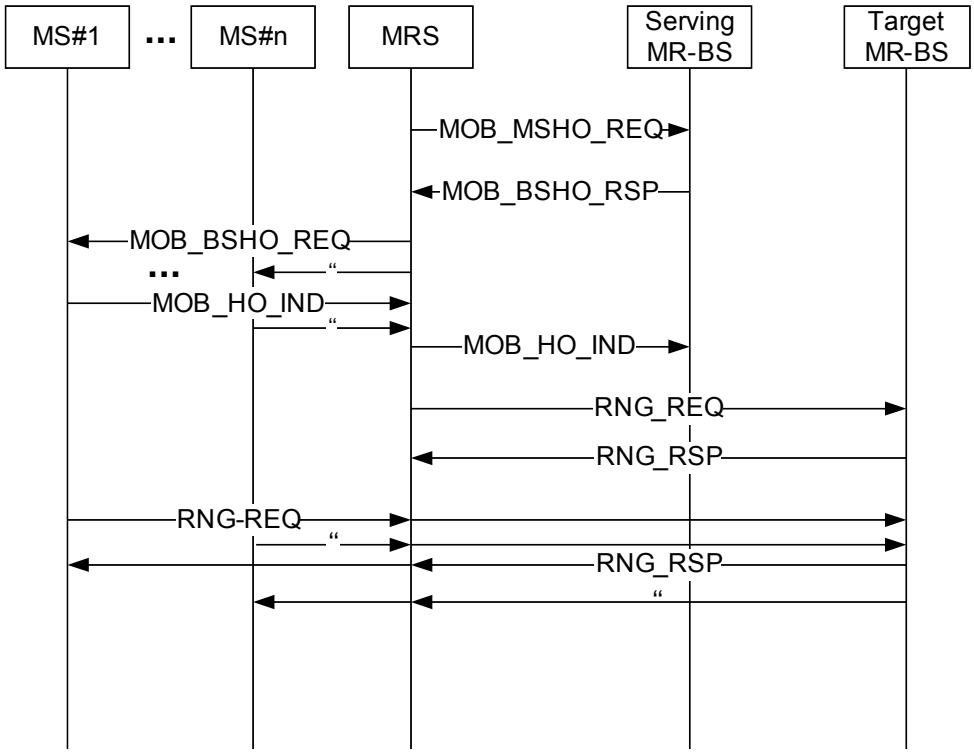

Figure 5-a. The example of MRS handover in case that the MRS shares security keys for MS with the MR-BS (MRS-initiated)

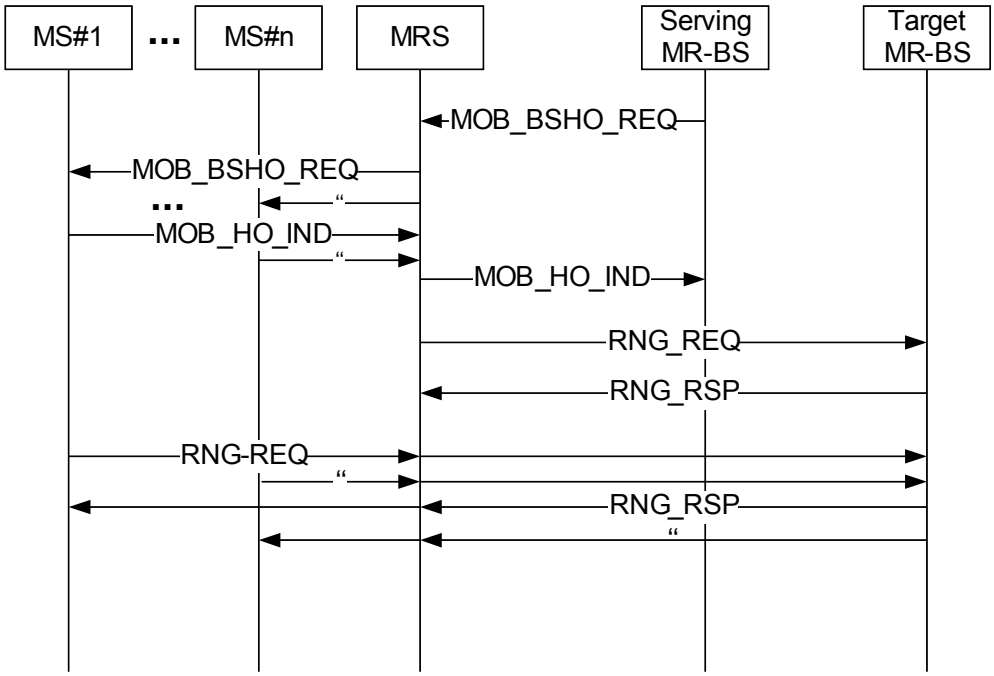

Figure 5-b. The example of MRS handover in case that the MRS shares security keys for MS with the MR-BS(MR-BS-initiated)

[*Edit note: This option that the MRS can share the security key to authenticate MAC management messages*

~~*of MS with MR-BS needs further study, whether it is feasible or not.*~~]

Text Proposals

6.3.2.3.52 BS HO Request (MOB_BSHO-REQ) message

Add the following text at the end:

The MOB_BSHO-REQ message shall include the following parameter encoded as TLV tuple for MRS:

Preamble Index (see 11.15.x)

6.3.2.3.54 BS HO Response (MOB_BSHO-RSP) message

Add the following text at the end:

The MOB_BSHO-RSP message shall include the following parameter encoded as TLV tuple for MRS:

Preamble Index (see 11.15.x)

11.15.x Preamble Index

This TLV is used for re-assignment of the preamble during the MRS handover.

Name	Type	Length	Value
Preamble Index	xx	1	A preamble index assigned to the MRS at the target MR-BS.

[Insert new subsection 6.3.2*2.4.2*:]

6.3.~~24~~ 22.4.2 Mobile RS Handover ~~Process~~with Preamble Change (Inter MR-BS)

This subclause ~~deals with~~describes the MRS handover (Inter MR-BS), which hands ~~off~~ over an MRS as well as all the MS attached to it, with ~~the~~ a detection of a preamble change. ~~A mobile RS can control MS handover.~~ Both of ~~T~~the MR-BS and the ~~mobile~~ MRS would maintain a list of MSs which are served through ~~the~~ an ~~relay link~~MRS. An MRS HO begins with a decision for an ~~mobile~~ MRS to handover itself and to ~~lead~~

make~~the~~ MSs to handover from a serving MR-BS to a target MR-BS. The decision may originate either at the ~~mobile~~ MRS or the serving MR-BS.

~~**6.3.24.1 xxx**~~

~~This subclause deals with the handover procedures including the handovers of subordinate MSs. In this case, the~~The operation of MRS Handover is divide~~des~~ into two steps: ~~the~~ a negotiation between an MRS and a serving MR-BS for MRS Handover, and ~~the~~ a procedure~~s~~ for MS Handover. ~~The trigger of MRS HO can be initiated by both the MRS and the MR-BS.~~

~~Initiating~~ MRS initiates handover by sending ~~MRS HO, a MRS sends a serving MR-BS~~ MOB_MSHO-REQ message to the serving MR-BS with its basic CID. The serving MR-BS ~~can~~ recognizes that an MRS is requesting~~s~~ ~~MRS~~ HO ~~as parsing~~from the basic CID in MAC header. Upon reception of MOB_MSHO-REQ message, the MR-BS sends MOB_BSHO-RSP message to the MRS.

If the target MR-BS decides ~~the MRS~~ to change ~~its~~ the MRS' preamble after the handover, the Preamble Index TLV ~~can be contained into~~is sent in the MOB_BSHO-REQ/RSP messages.

The MR-BS may set "Action Time" for fast handover ranging of the MRS using MOB_BSHO-REQ/RSP messages, which is similar to the MS Handover process in 6.3.22.2.

The serving MR-BS exchanges handover decision and initiation stage signaling (6.3.22.2.2) with each MS. ~~Then, the~~The ~~serving MR-BS begins HO for each MS, if MRS doesn't have the security keys to authenticate messages. The MRS sends~~ MOB_BSHO-REQ message is sent to the subordinate MSs~~. In this case,~~ with the "HO operation mode" ~~is~~ set to 1. In addition, the serving MR-BS may set "Action Time" in order to assign dedicated transmission opportunity for RNG-REQ message to be transmitted by the MS using Fast_Ranging_IE.

~~After the all handover request/response handshakes between the serving MR-BS and multiple MSs have completed, the MRS send a MOB_HO-IND message to the serving MR-BS in order to notify the completion of MS HO and its result indicated at the HO_IND_type fields.~~

When the serving MR-BS attempts a handover, it sends a MOB_BSHO-REQ message to the MRS. The subsequent procedures are ~~identical with the case of~~same as MRS initiated handover.

References

[1] Group Handover on the MRS, C802.16j-06_227r1.doc, Sungkyung Kim, Sungcheol Chang, Chulsik

Yoon, ETRI.

[2] MRS Handover in 802.16j (MMR) System, C802.16j-07_037r2.doc, Yousuf Saifullah, Shashikant Maheshwari, and Haihong Zheng, Nokia.

[3] Mobile Relay-Station Preamble Segment Re-assignment Scheme, C802.16j-07_041r4.doc, Peter Wang, Adrian Boariu, Shashikant, Maheshwari, and Yousuf Saifullah, Nokia.