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Title	**Mobility of transparent RS**	
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Re:	Response to Call for Technical Contributions regarding IEEE 802.16j (IEEE 802.16j-07/007r2).	
Abstract	This document proposes a handover solution for the Mobile RS with its attached MS.	
Purpose	Add the proposed spec changes in the 802.16j Baseline Document (IEEE 802.16j-06/026r2)	
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Mobility of Transparent RS

Introduction

In an MMR network, a Mobile RS is generally mounted on the vehicle and connected with an MR-BS or other RS via a wireless relay link. MRS provides a fixed wireless access link to MS/SS devices on the vehicle. Moreover, it shall have the capability of handover between neighboring access stations. When a Mobile RS is moving across the coverage of two neighboring access stations, both MRS and its attached MS may experience a handover process. Basically, there are two sorts of MRS handover scenarios in an MR network:

- target access station and serving access station have the same preamble (no scanning, no conventional handover occurred, e.g. transparent MRS performs intra-MR-BS handover)
- the preamble of the target access station is different from that of the serving access station (the procedure is similar to that of an MS, e.g. MRS performs inter-MR-BS handover)

The former case normally is an intra-MR-BS handover. MRS may not need to perform scanning and network re-entry procedures. The handover may be triggered by MR-BS when another potential target access station could provide better radio link quality to the MRS than that of the serving access station. The MRS intra-MR-BS handover may be conducted by the serving MR-BS updating the MAP.

In the second case, MRS may perform the handover procedures similar to that of MS handover defined in 6.3. 22.2. In addition, the MRS's attached MSs may also experience handover. When MRS is performing some handover procedures, such as scanning or ranging with the potential target access station, the connection between MRS the serving access station would be interrupted. During this period, all MSs attached to MRS can not send/get data to/from the serving MR-BS. The service continuity of the attached MSs would be interrupted.

In the baseline document, there are two sorts of defined RS, transparent RS and non-transparent RS. Therefore, there will be also two sorts of MRS. The advantages of transparent MRS includes:

- Since transparent MRS does not have to transmit broadcast control information, such as DL-MAP, UL-MAP FCH, etc., the implementation of MRS shall be much simpler.
- Handover only happens when MRS is moving across neighboring access stations with different preambles
- When MRS moves within the coverage of one serving access station (e.g. MR-BS), MRS and its attached MSs will not perform the handover
- Less handover signaling
- Support both single frequency and multi-frequency reuse cases

This contribution proposes a handover approach and mechanism for transparent Mobile Relay Stations. It not only fully complies with existing handover process defined in IEEE802.16e, but also maintains the service continuity of the MS attached to the MRS.

Proposed Solution

A transparent MRS would not perform any HO when it moves within the coverage of the same serving station. The HO of a transparent MRS only occurs when it tries to move across the neighboring MR-BSs. This contribution proposes a handover solution for such cases.

In the in-band relay scheme, the associated MSs always get synchronization with the MRS's serving station in stead of the MRs. When Mobile RS is moving across two neighboring access stations, both MRS and its attached MS may experience a handover process. When MRS is performing target access station scanning, ranging or other handover procedures, the relay link between MRS the serving access station would be interrupted. Consequently, the service continuity of the MSs associated to the MRS is interrupted at this moment. In order to maintain the service continuity of the MSs associated to the MRS. A MRS handover solution is proposed as indicated in Figure 1. Generally, there are three steps:

- **Fisrt, MRS's subordinate MSs attach to the interim access station.** Before MRS tries to scan potential target MR-BS or RS, the serving MR-BS conducts the MS associated with MRS to attach to the interim access station, which could be the serving MR-BS or other neighboring RS providing better signal quality. This handover could be triggered by decreasing the MRS power level or initiated by the serving MR-BS.
- **MRS HO from the serving access station to the target access station.** Following the completion of MS attaching to the interim access station (e.g. serving MR-BS), MRS shall performs cell selection by scanning neighboring target stations. If the HO decision is successfully initiated, MRS would follow the other procedures defined in 6.3.22.2 to complete the HO from the access station to target access station. If the HO trigger condition is not satisfied or it is failed to make the HO decision, the HO process will be canceled and the MRS shall re-attach to the serving access station. During the MRS HO process, MS keeps communication with the interim access station instead of the MRS.
- **MS HO to MRS.** After MRS completes the handover from the serving access station to the target access station, the quality of the radio link between the associated MS and the MRS would be better than others. Therefore, the MSs originally attached to the MRS will be triggered to perform the handover from interim access station to the MRS.

The Mobile RS (MRS) handover process deals with handover of the MRS along with all the attached MSs to a target access station. During the handover process, the MRS performs the procedures with the access station and the target access station in the similar way as an MS does.

Figure 1 illustrates the proposed handover procedure for transparent MRS inter-MR-BS handover with its attached MS between two neighboring BSs. Generally, the handover process consists of the following steps.

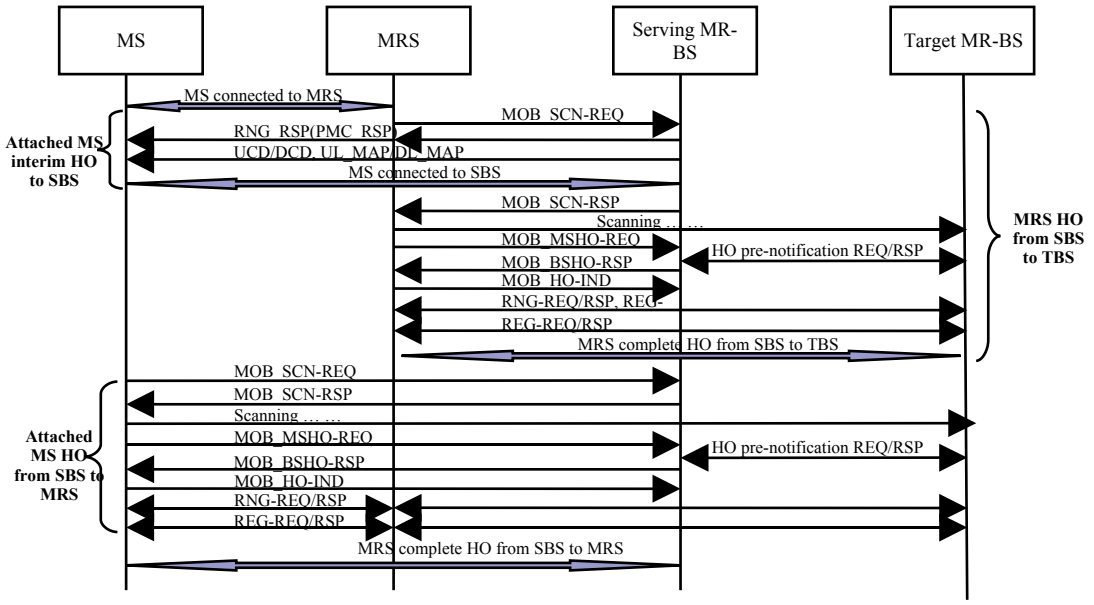

Figure 2 Procedures of transparent MRS handover with its attached MS

1. MRS sends MOB_SCN-REQ to the serving MR-BS to request to perform scanning.
2. The serving MR-BS updates the power and the radio resource allocation by sending the updated RNG_RSP and UL_MAP/DL_MAP to the MSs attaching to the MRS.
3. MR-BS sends MOB_SCN-RSP to MRS to initiate MRS scanning.
4. MRS performs scanning potential Target MR-BS.
5. When the HO criterion is met, MRS sends MOB_MSHO-REQ to the Serving MR-BS to request to initiate handover.
6. Upon getting MOB_MSHO-REQ message from MRS, the Serving MR-BS shall negotiate with the potential target MR-BS to exchange the related parameters over the backbone network.
7. The Serving MR-BS sends MOB_BSHO-RSP to the MRS to acknowledge the handover request from MRS.
8. MRS transmits MOB_HO-IND to the serving MR-BS as the indication that MRS handoff from the serving MR-BS to the target MR-BS.
9. MRS performs ranging with the target MR-BS by sending RNG-REQ and getting RNG-RSP message from the target MR-BS.
10. MRS performs network re-entry by exchanging the messages of REG-REQ and REG-RSP with the target MR-BS.
11. The MS performs the handover procedures as defined in 6.3.22.2 to handoff from the serving MR-BS to the MRS.

Conclusion

The transparent MRS handover only occurs when the MRS moves across the coverage of two neighboring access stations with different preambles. This proposal provides a solution for the handover of the transparent

MRS with its attached MS. It requires less modification on the existing handover procedures defined in IEEE Std. 802.16e. The service continuity of the MRS's attached MS can be maintained.

Proposed text changes

++++++++++++ start text proposal ++++++++++++++++++++++++++++++++++

[Make the indicated modifications to section 6.3.22:]

6.3.22 MAC layer handover procedures

This subclause contains the procedures performed during handover (HO).

An MS shall be capable of performing handover using the procedures defined in 6.3.22.2.

A Mobile RS shall be capable of performing handover using the procedures defined in 6.3.22.4.

The handover process defined in this subclause may be used in a number of situations. Some examples are as follows:

– When the MS or the MRS moves and (due to signal fading, interference levels, etc.) needs to change the BS to which it is connected in order to provide a higher signal quality;

– When the MS or the MRS can be serviced with higher QoS at another BS;

The handover decision algorithm is beyond the scope of the standard.

[Insert the new subcluase 6.3.22.4]

6.3.22.4 Mobile RS HO

6.3.22.4.1 Transparent MRS HO

The subclause defines the transparent MRS HO process in which a transparent MRS with its attached MSs migrates from the air-interface provided by the serving access station to the air-interface provided by the target access station. Unless otherwise indicated in this subclause, MRS HO process is processed according to MS handover process defined in 6.3.22.2.

In order to maintain the service continuity of the MSs associated to the MRS when the MRS is performing scan of potential target access station or other HO procedures, the serving MR-BS shall conduct the MSs associated to MRS to attach to the MR-BS or other neighboring access station. Once the MRS HO process complete, the MSs originally associated to the MRS shall performs the process defined in 6.3.22.2 to handover from the serving MR-BS to the MRS.

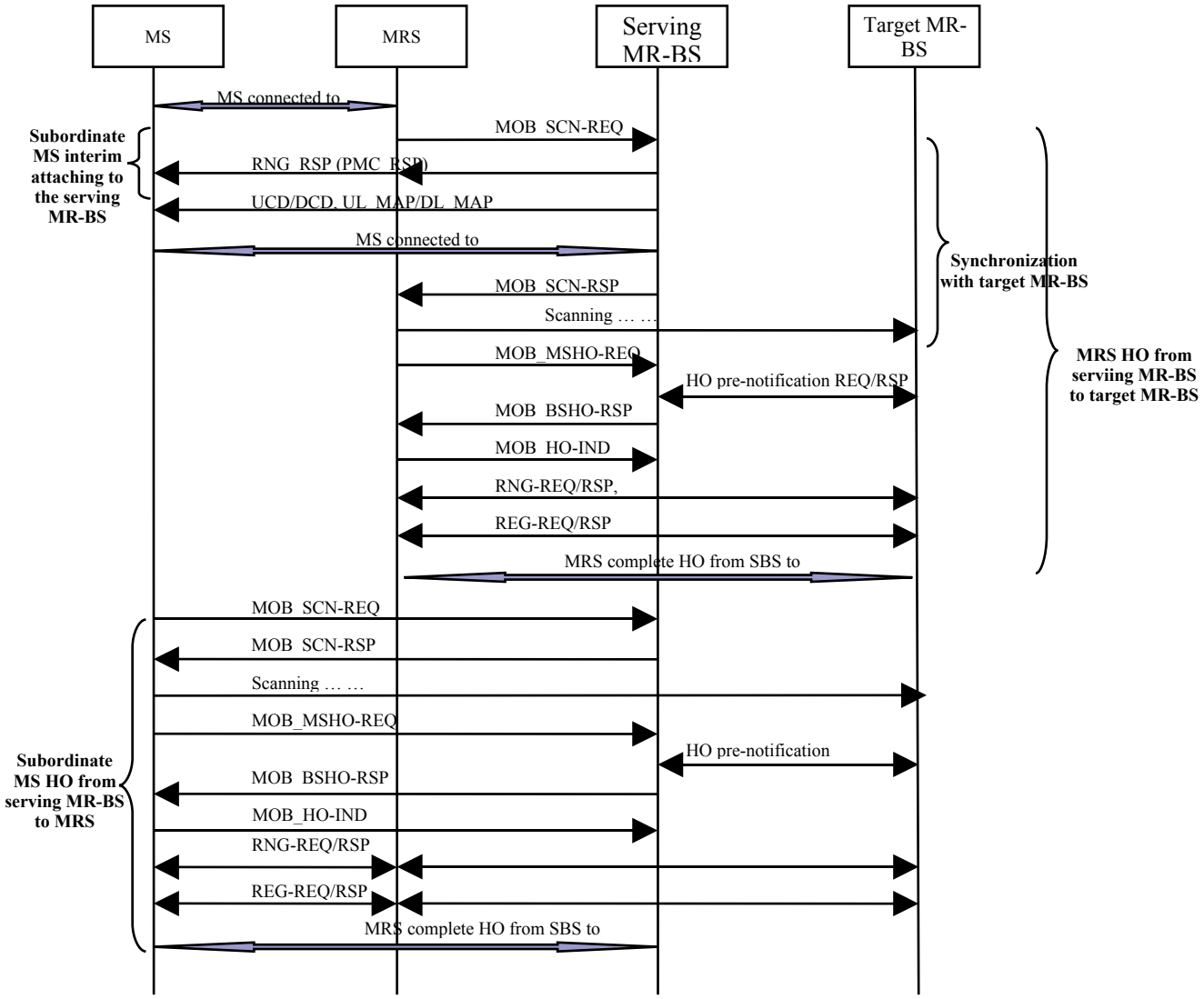

Figure 2 Procedures of transparent MRS handover

6.3.22.4.2 Non-transparent MRS HO

++++++++++++++++++++ *End of text proposal* ++++++++++++++++++++

Reference

[1] IEEE C802.16j-06/051, Recommendations on IEEE802.16j Technical Requirements