



## **MS-handover support directed by MMR-BS**

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### **Introduction**

In 802.16j, an RS that is functioning as an access station as well as an MMR-BS should support MS handover operation. We assume that the extent to which an RS is able to support MS handover depends on the RS capability, which can be quite different. In some cases, RSs may be capable of performing the whole handover process including negotiation procedures with MS, while in some other instances RSs may execute the whole, or a part of the, process according to commands from MMR-BS. Based on pre-negotiated capabilities with its serving MMR-BS, RS just forwards handover signals of MS and MMR-BS or RS composes handover signals between RS and MMR-BS. In this contribution, we propose the messages and the protocol that will facilitate the MS handover by RS, directed by the MMR-BS. The case wherein RS handles the MS handover by itself is discussed in another contribution [1].

### **Problem Statement**

In the current 802.16e MS handover operation, an MS initiates the handover by transmitting the MOB\_MSHO-REQ message to its serving BS and receives the MOB\_BSHO-RSP message as a response from the serving BS. The serving BS itself may also initiate MS handover by transmitting MOB\_BSHO-REQ message. In either case, the serving BS indicates possible target BSs, which can be obtained, for instance, based on the message exchange that may take place over the backbone network messages with the neighboring BSs to obtain expected MS performance at the BSs. An MS sends MOB\_HO-IND with HO\_IND\_type=0b00 indicating a commitment to handover. If the MS signals rejection of the serving BS's instruction to handover through MOB\_HO-IND with HO\_IND\_type=0b10, the serving BS may reconfigure the neighbor BS list and retransmit MOB\_BSHO-RSP message. The MS may cancel the handover at any time by transmitting MOB\_HO-IND with HO\_IND\_type=0b01.

In 802.16j, an MMR-BS may determine to initiate handover operation of an MS which is not directly attached to the MMR-BS, but controlled by it. In such a case, the MMR-BS directs the RS, to which the MS is directly attached, to transmit the MS handover initiation signal on its behalf. Similarly, if the MMR-BS receives a MS handover request via an RS, to which an MS is directly attached, the MMR-BS shall instruct the RS to which the MS is directly attached to send the MOB\_BSHO-RSP on its behalf containing the information of

possible target MMR-BSs or RSs.

So, in this contribution we propose that the MMR-BS direct the RS, to which the MS is directly attached, to support the handover of MS.

## Suggested Remedy

Using the scheme described below, an RS will be able to support MS handover according to the direction of MMR-BS.

An MMR-BS decides to trigger handover of an MS which is directly attached to an RS and obtains the information of possible target access station(s) to which the MS may handover. After getting the information, the MMR-BS sends a MMR\_MSHO-CMD message to direct the access RS to transmit MOB\_BSHO-REQ which triggers BS-initiated MS handover. If the MMR-BS needs to force the MS to conduct handover, the MMR-BS shall send MMR\_MSHO-CMD with command indicator=01 indicating that the access RS shall make MOB\_BSHO-REQ including HO operation mode set to Mandatory HO request.

When an RS receives MOB\_MSHO-REQ, it may compose MMR\_MSHOREQ-IND message to inform MMR-BS of MS handover request. When responding to MS handover request, transmitted by an MS to initiate MS handover, an MMR-BS may direct the access RS to transmit MOB\_BSHO-RSP message on its behalf. If an MS signals rejection of serving BS instruction to HO through MOB\_HO-IND with HO\_IND\_type=0b10, the MMR-BS may reconfigure a new recommended target access stations list and transmit MMR\_MSHO-CMD message to direct the access RS to send MOB\_BSHO-RSP message with the new list.

Upon receiving MMR\_MSHO-CMD message, the access RS shall transmit MOB\_BSHO-REQ or MOB\_BSHO-RSP message as instructed in the MMR\_MSHO-CMD. In other words, the access RS shall configure MOB\_BSHO-REQ or MOB\_BSHO-RSP using the information of expected MS performance as well as possible target access stations list in MMR\_MSHO-CMD and send the MOB\_BSHO-REQ or MOB\_BSHO-RSP to an MS which attached to the access RS.

A MMR\_MSHO-CMD message sent by an MMR-BS includes a 'Command indicator' field which gives instructions to an access RS to transmit MOB\_BSHO-REQ or MOB\_BSHO-RSP to force the MS to conduct handover or the access RS to transmit the MOB\_BSHO-REQ message, or MOB\_BSHO-RSP to trigger BS-recommended MS handover.

Accordingly we propose the remedies as follows:

- Define a new message flow between an access RS and its MMR-BS for directing the access RS to support MS handover operation
- Define new control messages which provides the access RS with the information of MS handover support
  - An MMR\_MSHO-CMD message with MMR-BS's command indicator as well as a recommended target access stations list
  - An MMR\_MSHOREQ-IND message to inform MS handover request

## Proposed Text Change

*[Remedy1: Insert the followings at the end of section 6.3.22.2.2]*

*[Insert the followings at the end of section 6.3.22.2.2:]*

If an MMR-BS decides to trigger the handover of an MS which is served in one of its subordinate RS cells, it may choose a list of recommended target access station(s) and instructs the access RS to initiate a handover procedure with the MS. The MMR-BS sends a MMR\_MSHO-CMD message to the access RS for this purpose, and in turn, the access RS sends a MOB\_BSHO-REQ message built from the information within the MMR\_MSHO-CMD message. If the MMR-BS receives a MMR\_MSHO-REQ-IND message transmitted by an access RS to indicate handover request from an MS, it may instruct the access RS to send a MOB\_BSHO-RSP message as a response to the MOB\_MSHO-REQ. If the MMR-BS needs to force an MS to conduct handover, it shall include Command indicator=01 in MMR\_MSHO-CMD to inform the access RS of the fact that the access RS shall transmit MOB\_BSHO-REQ or MOB\_BSHO-RSP with HO operation mode field set to ‘Mandatory HO request’.

Upon receipt of a MMR\_MSHO-CMD message, the access RS shall transmit MOB\_BSHO-REQ or MOB\_BSHO-RSP as indicated by the Command indicator in the MMR\_MSHO-CMD. The MMR\_MSHO-CMD may contain a recommended target access station list and the expected service level at each access station in the list.

If the MOB\_HO-IND message which is relayed by the access RS to an MMR-BS contains HO\_IND\_type=0b10, indicating a handover rejection, the MMR-BS may reconfigure the recommended target access station list and transmit a MMR\_MSHO-CMD message to direct the access RS to send a new MOB\_BSHO-RSP message including the new list.

*[Remedy 2: Insert the followings after section 6.3.2.3.61 at page 172]*

*[Insert new subclauses 6.3.2.3.xx after section 6.3.2.3.61:]*

### 6.3.2.3.xx MS Handover Command (MMR\_MSHO-CMD) message

A MMR\_MSHO-CMD message may be transmitted by an MMR-BS to direct an access RS to compose and transmit MOB\_BSHO-REQ message or MOB\_BSHO-RSP message. If ‘Command indicator’ bits in the MMR\_MSHO-CMD message are ‘00’, the access RS shall compose a MOB\_BSHO-REQ message including HO operation mode set to ‘Recommended HO request’ and then transmit the MOB\_BSHO-REQ message. If

'Command indicator' bits are set to '01', the access RS shall compose a MOB\_BSHO-REQ message including HO operation mode set to 'Mandatory HO request' and then transmit the MOB\_BSHO-REQ message. If the 'Command indicator' bits are set to '10', the access RS shall compose a MOB\_BSHO-RSP message including HO operation mode set to 'Recommended HO request' and then transmit the MOB\_BSHO-RSP message. If the 'Command indicator' bits are set to 11, the access RS shall compose a MOB\_BSHO-RSP message including HO operation mode set to 'Mandatory HO request' and transmit the MOB\_BSHO-RSP message.  
The MMR-BS shall provide the access RS with a list of recommended target access station(s) and its related information used for handover in MMR\_MSHO-CMD message.

An MMR-BS shall generate MMR\_MSHO-CMD messages in the format shown in Table x.

Table x – MMR\_MSHO-CMD message format

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>MMR_MSHO-CMD_Message_format() {</u>	<u>=</u>	
<u>Management Message Type=TBD</u>	<u>8 bits</u>	<u>=</u>
<u>Command indicator</u>	<u>2 bits</u>	<u>This field indicates MMR-BS's direction.</u> <u>00: issue MOB_BSHO-REQ including Handover operation mode set to 'Recommended HO request'</u> <u>01: issue MOB_BSHO-REQ including Handover operation mode set to 'Mandatory HO request'</u> <u>10: issue MOB_BSHO-RSP including Handover operation mode set to 'Recommended HO request'</u> <u>11: issue MOB_BSHO-RSP including Handover operation mode set to 'Mandatory HO request'</u>
<u>CID</u>	<u>16 bits</u>	<u>Basic CID of MS</u>
<u>Resource retain timer flag</u>	<u>2 bit</u>	<u>00: no resource retained</u> <u>01: Use resource retain timer negotiated in REG-REQ/RSP</u> <u>10: Use New resource retain timer</u> <u>11: reserved</u>

<u>If(Resource retain timer flag==10){</u>		
<u>  New resource retain timer</u>	<u>8bits</u>	
<u>  }</u>		
<u>  N_Recommended</u>	<u>6 bits</u>	<u>Number of recommended access stations</u>
<u>  For(i=0; i&lt;N_Recommended; i++){</u>		
<u>    Neighbor Station ID</u>	<u>48 bits</u>	<u>MAC address of the access station</u>
<u>    Service level prediction</u>	<u>4 bits</u>	=
<u>    HO process optimization</u>	<u>8 bits</u>	=
<u>    HO_ID_included_indicator</u>	<u>1 bit</u>	<u>Indicates whether the field HO_ID is included</u>
<u>    If(HO_ID_included_indicator==1){</u>		
<u>      HO_ID</u>	<u>8 bits</u>	<u>ID assigned for use in initial ranging to the target access station once this access station is selected as the target access station.</u>
<u>    }</u>		
<u>  }</u>		
<u>  Action time</u>	<u>8 bits</u>	=
<u>}</u>		

The following parameters shall be included in the MMR\_MSHO-CMD message:

Command indicator

Indicates which Handover operation mode of HO message should be configured by the access RS.

00 = issue MOB\_BSHO-REQ message including Handover operation mode set to ‘Recommended HO request’

01 = issue MOB\_BSHO-REQ message including Handover operation mode set to ‘Mandatory HO request’

10 = issue MOB\_BSHO-RSP message including Handover operation mode set to ‘Recommended HO request’

11 = issue MOB\_BSHO-RSP message including Handover operation mode set to ‘Mandatory HO request’

CID

Basic CID of MS

Resource retain timer flag

Indicates whether the connection information of the MS will be retained or deleted upon receiving the MOB\_HO-IND with HO\_IND\_type=0b00. If the flag is set to 01, the connection information of the MS will be retained during the time in System Resource Retain Time timer negotiated in REG-REQ/RSP. If the flag is set to 10, the connection information of the MS will be retained during the New resource retain timer in this message. If the flag is set to 00, the connection information of the MS will be discarded.

Neighbor Station ID

Same as the Base Station ID parameter in the DL-MAP message of this access station.

Service level prediction

The service level prediction value indicates the level of service the MS can expect from this access station. The following encodings apply:

0 = No service possible for this MS

1 = Some service is available for one or several service flows authorized for the MS.

2 = For each authorized service flow, a MAC connection can be established with QoS specified by the AuthorizedQoSParamSet.

3 = No service level prediction available.

HO process optimization

HO process optimization provided as a part of this message is indicative only. HO process requirements may change at the time of the actual HO. For each Bit location, a '0' indicates that the associated reentry management messages shall be required, a '1' indicates that the reentry management message may be omitted.

Bit #0: Omit SBC-REQ/RSP management messages during re-entry processing

Bit #1: Omit PKM authentication phase except TEK phase during current reentry processing

Bit #2: Omit PKM TEK creation phase during reentry processing

Bit #3: Omit REG-REQ/RSP management during current reentry processing

Bit #4: Omit Network Address Acquisition management messages during current reentry Processing

Bit #5: Omit Time of Day Acquisition management messages during current reentry processing

Bit #6: Omit TFTP management messages during current reentry processing

Bit #7: Full service and operational state transfer or sharing between serving station and target station (ARQ, timers, counters, MAC state machines, etc.)

HO\_ID\_included\_indicator

Indicates whether HO\_ID will be included or not in MOB\_BSHO-REQ or MOB\_BSHO-RSP message. If HO\_ID\_included\_indicator is set to 1, HO\_ID in this message shall be included in MOB\_BSHO-REQ or MOB\_BSHO-RSP.

## References

- [1] C80216j-06\_0xx\_MS handover support by RS