

Project	IEEE 802.16 Broadband Wireless Access Working Group < <a href="http://ieee802.org/16">http://ieee802.org/16</a> >	
Title	Association Procedure in a centralized MR system with Distributed Scheduling	
Date Submitted	2007-03-05	
Source(s)	<p>Shulan Feng, Yanling Lu, Ting Li, Liangliang Zhang Hisilicon Technologies Harbour Building, No.8, Dongbeiwang West Road, HaiDian District, Beijing, China</p> <p>Voice: 86-10-82829010 Fax: 86-10-82829075 mailto:luyanling@hisilicon.com fengsl@huawei.com</p>	<p>Hyunjeong Lee Intel Corporation 2111 NE 25th Ave Hillsboro, OR 97124 mail to: Hyunjeong.hannah.lee@intel.com</p> <p>Hyunjeong Kang Samsung Electronics mailto:hyunjeong.kang@samsung.com</p>
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# Association Procedure in a Centralized MR System with Distributed Scheduling

Shulan Feng, Yanling Lu, Ting Li, Liangliang Zhang  
Hisilicon Technologies

Hyunjeong Lee  
Intel Corporation

Hyunjeong Kang  
Samsung Electronics

## 1. Introduction

This contribution proposes a method for RS to support 802.16e compliant MS scanning with association in a centralized multi-hop relay (MR) network with distributed scheduling.

## 2. Problem Statement

As in IEEE 802.16e-2005, the MR-BS may send the MOB\_SCN-RSP message unsolicited or as a response of the MOB\_SCN-REQ message from the MS. However, in a centralized MR system with distributed scheduling, when the serving MR-BS decides to recommend the MS to scan neighbor stations with association level 1 or 2, it should obtain association parameters allocated by the neighbor stations before sending the MOB\_SCN-RSP message. If the neighbor station is a MR-BS, the association procedure follows IEEE 802.16e-2005. Otherwise, the method for the MR-BS to obtain the association parameters from a neighbor RS needs to be defined.

After the association parameter acquisition procedure, the MS may scan the neighbor RSs with association. There is no change for the MS, while the RS and MR-BS's function should be defined according to legacy standard and MS network entry procedure for a non transparent RS with distributed scheduling [1].

## 3. Suggested Remedy

### 3.1 Association parameter acquisition

As in IEEE 802.16e-2005, the association parameters acquisition procedure between the serving MR-BS and the neighbor MR-BS occurs over the backbone when the recommended neighbor RS stations are in different MR-cells. Then, the neighbor MR-BS may obtain the association parameters of its subordinate recommended RSs and respond to the serving MR-BS. If the neighbor RSs are served by the serving MR-BS, the serving MR-BS can directly request the association parameters from the neighbor RSs.

The MR-BS may respectively send an association request (ASC-REQ) message to its subordinate recommended neighbor RS, requesting the association level. The recommended neighbor RS shall response

with an association response (ASC-RSP) message to indicate the association level allocated to the MS. If the allocated association level is 1 or 2, the ASC-RSP should include the association parameters (i.e. Rendezvous time, CDMA code, and Transmission\_opportunity offset) further. Figure 1 is an example of association parameter acquisition procedure.

The association parameters in the ASC-RSP will be delivered to the serving MR-BS on a multi-hop link and via the backbone network, which leads to the time delay. So Rendezvous Time in the ASC-RSP should be the offset calculated from the frame where the ASC-RSP is transmitted by the neighbor RS. The Rendezvous Time in the MOB\_SCN-RSP message will be determined by the serving MR-BS to compensate the time delay between the neighbor RS and the serving MR-BS.

The serving BS (of the associating MS), will coordinate to assure that the neighboring station do not assign overlapping or too close in time to each other ranging regions. The serving MR-BS may determine whether the responded association parameters are satisfied or not. If not, the serving MR-BS may request the association parameters for more times.

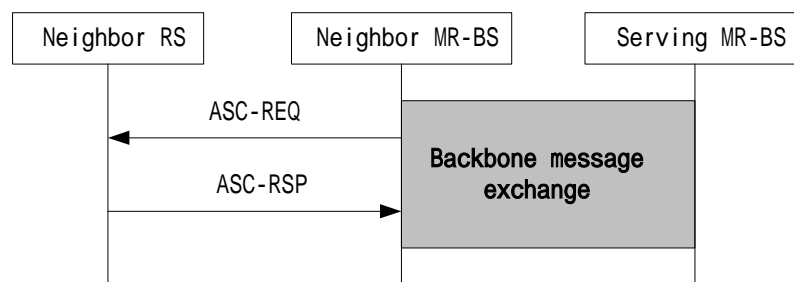


Figure 1-An example of association parameter acquisition procedure

### 3.2 Association level 0

When this association level is chosen by the network, the MS may perform association with level 0.

After the scanned RS successfully receives the ranging code, it will provide uplink allocation of adequate size for the MS to transmit RNG-REQ message with TLV parameters (Serving BS ID, MS MAC address) related to the association ranging. The RNG-REQ message is sent by the MS and relayed to the MR-BS, then the MR-BS responds with RNG-RSP message, which is relayed to the MS.

### 3.3 Association level 1

When the MS performs the association with level 1, it shall synchronize to the neighbor RS at the first frame immediately following the rendezvous time, read the UL-MAP transmitted at this frame and determine the specific region used for transmission of the dedicated CDMA code, based on information from the UL-MAP and Transmission opportunity offset" field in MOB\_SCN-RSP. In case the neighbor RS decides to provide a

regular (non-dedicated) ranging region with Dedicated ranging indicator set to 0, the MS may transmit the allocated CDMA code in the regular ranging region. If the MS could not obtain UL\_MAP at the first frame immediately following the rendezvous time, it may perform the Level 0 association with this RS.

After the scanned RS successfully receives the ranging code, it will provide uplink allocation of adequate size for the MS to transmit RNG-REQ message with TLV parameters (Serving BS ID, MS MAC address) related to the association ranging. The RNG-REQ message is sent by the MS and relayed to the MR-BS, then the MR-BS responds with RNG-RSP message, which is relayed to the MS.

### 3.4 Association with level 2

During the scanning with association level 2, the MS is required to transmit the CDMA ranging code to the scanned neighbor RS. The MS does not have to wait for RNG-RSP from the scanned neighbor RS. Instead, the neighbor RS shall send the RNG-RSP message to its serving MR-BS (the MS's neighbor MR-BS). The neighbor MR-BS should send the ranging information to the serving MR-BS via backbone network. Then the MS's serving MR-BS shall incorporate the RNG-RSP information from all the neighbor MR-BSs into a single MOB\_ASC\_REP message. If the neighbor RS is served by the serving MR-BS, it will directly send the RNG-RSP to the serving MR-BS. Figure 2 is an example of scanning with association level 2.

When the MS's access station is the serving MR-BS, it shall send the MOB\_ASC\_REP message to the MS. Otherwise, the MOB\_ASC\_REP message shall be relayed to the MS.

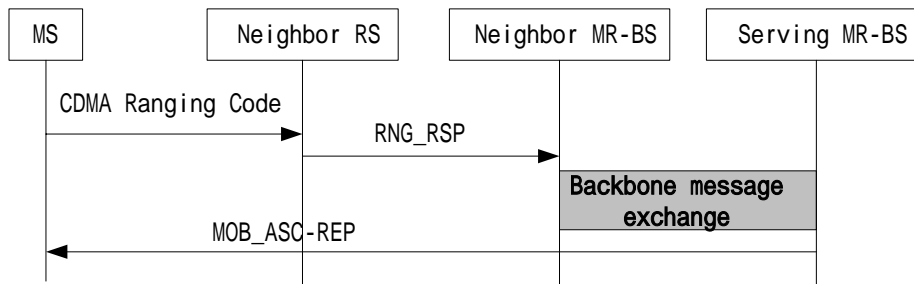


Figure 2-An example of scanning with association level 2

## 4. Proposed text

### 6.3.2.3 MAC management message

[Add two rows into Table 14: ]

Type	Message Name	Message Description	Connection
<TBD>	ASC-REQ	Association Request	Basic
<TBD>	ASC-RSP	Association Response	Basic

*[Insert new subclause 6.3.2.3.xx]*

### 6.3.2.3.XX ASC-REQ

A MR-BS sends this message to negotiate the association parameters over relay links.

Syntax	Size	Notes
ASC-REQ_Message_format () {	-	
Management Message Type=TBD	8bits	
MS ID	48bits	
Requested Scanning Type	2 bits	0b00: Scanning with Association level 1; 0b01: Scanning with Association level 2; 0b10,0b11: Reserved
Padding	Variable	If needed for alignment to byte boundary.
}	-	

The following parameters shall be included in the ASC\_REQ:

MS\_ID

MS's MAC address

Neighbor\_station\_Index

Station MAC addresses.

Requested Scanning Type

Requested Scanning Type depending on the association level

*[Insert new subclause 6.3.2.3.xx]*

### 6.3.2.3.XX ASC-RSP

A RS transmits this message to respond to the ASC -REQ message.

Syntax	Size	Notes
ASC-RSP_Message_format () {	-	
Management Message Type=TBD	8bits	
MS ID	48bits	

Scanning Type	2 bits	0b00: Scanning with Association level 0; 0b01: Scanning with Association level 1; 0b10: Scanning with Association level 2; 0b11: Reserved
if (Scanning Type > 0){		
Rendezvous time	8 bits	The offset is calculated from the frame where ASC-RSP is transmitted by the neighbor RS.
CDMA code	8 bits	
Transmission_opportunity offset	8 bits	
}		
Padding	Variable	If needed for alignment to byte boundary.
}	-	

The following parameters shall be included in the ASC\_RSP:

MS\_ID

MS's MAC address

Neighbor\_station\_Index

Station MAC addresses

Scanning Type

Scanning Type allocated by the neighbor station to the MS

*[Insert new subclause 6.3.22.4.3]*

6.3.22.4.3 Association procedure in an MR network

In a centralized MR system with distributed scheduling

6.3.22.4.3. 1 Association parameter acquisition

In a centralized MS system with distributed scheduling, when the serving MR-BS decides to recommend the MS to scan neighbor stations with association level 1 or 2, it should obtain association parameters allocated by the neighbor stations before sending the MOB\_SCN-RSP message.

If the neighbor stations are in different MR-cells, the serving MR-BS shall request association parameters from the neighbor MR-BS via backbone network. Then the neighbor MR-BS can obtain the association parameters of its subordinate recommended RSs and respond to the serving MR-BS. If the neighbor RSs are served by the serving MR-BS, the serving MR-BS can directly request the association parameters from the neighbor RSs.

The MR-BS may respectively send an association request (ASC-REQ) message to its subordinate recommended neighbor RS, requesting the association level. The recommended neighbor RS shall respond with an association response (ASC-RSP) message to indicate the association level allocated to the MS. If the allocated association level is 1 or 2, the ASC-RSP should include the association parameters (i.e. Rendezvous time, CDMA code, and Transmission\_opportunity offset) further.

The serving MR-BS may determine whether the responded association parameters are satisfied or not. If not, the serving MR-BS may request the association parameters for more times.

#### 6.3.22.4.3.1 Association level 0

When this association level is chosen by the network, the MS may perform association with level 0.

After the scanned RS successfully receives the ranging code, it will provide uplink allocation of adequate size for the MS to transmit RNG-REQ message with TLV parameters (Serving BS ID, MS MAC address) related to the association ranging. The RNG-REQ message is sent by the MS and relayed to the MR-BS, then the MR-BS responds with RNG-RSP message, which is relayed to the MS.

#### 6.3.22.4.3.2 Association level 1

When the MS performs the association with level 1, there is no change for the MS, while the neighbor RS shall be synchronized .

After the scanned RS successfully receives the ranging code, it will provide uplink allocation of adequate size for the MS to transmit RNG-REQ message with TLV parameters (Serving BS ID, MS MAC address) related to the association ranging. The RNG-REQ message is sent by the MS and relayed to the MR-BS, then the MR-BS responds with RNG-RSP message.

#### 6.3.22.4.3.4 Association level 2

During the scanning with association level 2, the MS is required to transmit the CDMA ranging code to the scanned neighbor RS. The MS does not have to wait for RNG-RSP from the scanned neighbor RS. Instead, the neighbor RS shall send the RNG-RSP to its serving MR-BS (the MS's neighbor MR-BS). The neighbor MR-BS should send the ranging information to the serving MR-BS via backbone network. Then the MS's serving MR-BS shall incorporate the RNG-RSP information from all the neighbor MR-BSs into a single MOB\_ASC\_REP message. If the neighbor RS is served by the serving MR-BS, it will directly send the RNG-RSP to the serving MR-BS.

## References

- [1] IEEE 802.16j-07/024r2, “ MS network entry for non-transparent Relay Station with Distributed Scheduling”.