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Re:	This contribution is a response to " IEEE 802.16j-06/034 Call for Technical Proposals regarding IEEE Project 802.16j" (2006-12-12) .	
Abstract	This contribution describes the proposed association procedure in 802.16j system.	
Purpose	This document is provided in response for Call for Technical Proposals regarding IEEE Project 802.16j .	
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## Association Procedure in 802.16j

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### 1. Introduction

This contribution proposes a method for RS to support 802.16e compliant MS scanning with association in the multi-hop relay (MR) network. In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026 are listed in Section 4.

In this proposed association procedure, it is assumed that RSs as well as MR-BSs transmit their own broadcast control messages such as preamble, FCH, DCD, UCD, DL-MAP and UL-MAP. In a distributed MR network, an RS may have a capability of authentication on management messages from/to an MS. Please refer to Sections 1.1 of [4] for terminologies used in this contribution.

### 2. Problem Statement

In a centralized MR system, the access station may relay the MOB\_SCN-REQ generated by the MR to the serving MR-BS and MOB\_SCN-RSP generated by the serving MR-BS to the MS. 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 stations are in different MR-cells. However, in a distributed MR system, the access station of the MS may send the MOB\_SCN-RSP message unsolicited or as a response after receiving the MOB\_SCN-REQ message. When the access station decides to recommend the MS to scan one or more 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. Thus, the method for the access station to obtain the association parameters for the MS needs to be defined. Furthermore, when the MS scans one or more neighbor stations with association level 2 in a distributed MR system, the method for the access station to obtain RNG-RSP information from the scanned neighbor stations should also be defined. MS scanning signal processing by the access RS is based on the capability negotiated during initial network entry of the RS [4].

### 3. Suggested Remedy

#### 3.1 Association parameter acquisition

When the MS in a distributed MR system scans the neighbor station with association level 0, the access station does not need to request the neighbor station to allocate the association parameters to the MS.

However, when the access station in a distributed MR system recommends the neighbor station to be scanned by the MS with association level 1 or 2, the association parameter acquisition procedure is necessary. We suggest that in a distributed MR system the serving MR-BS or the access RS may obtain the association parameters (i.e. rendezvous time, CDMA code and Transmission\_opportunity offset) from the neighbor stations to be scanned with association level 1 or 2. Thus, we propose the association parameter acquisition procedure in a distributed system in the following cases.

■ Case 1: The access station is the MR-BS

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 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.

When the recommended neighbor station is an RS and if the MR-BS does not know the allocation detail at the recommended RS, the association parameters can be obtained over relay links. The MR-BS may respectively send an association request (ASC -REQ) message to its subordinate recommended neighbor RS, requesting the association parameters. The recommended neighbor RS shall response with an association response (ASC -RSP) message to indicate the association parameters it decides to allocate to the MS.

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

■ Case 2: The access station is the RS

The access RS may send an association request (ASC-REQ) message to the serving MR-BS to indicate the neighbor stations it intends to recommend the MS to scan with association level 1 or level 2. The serving MR-BS shall request association parameters in a fashion similar to case 1. If the serving MR-BS obtains satisfied association parameters from one or more recommended neighbor stations, it shall send an association response (ASC-RSP) message to the access RS to indicate all of the satisfied association parameters. In an MR network with distributed scheduling, if access and recommended RSs can communicate directly over the 1-hop relay link between them, the access RS may send and receive ASC-REQ and ASC-RSP messages directly to and from the recommended RS.

Figure 1 describes an example of the association acquisition flow in the case when both the access station and the recommended neighbor station are RSs

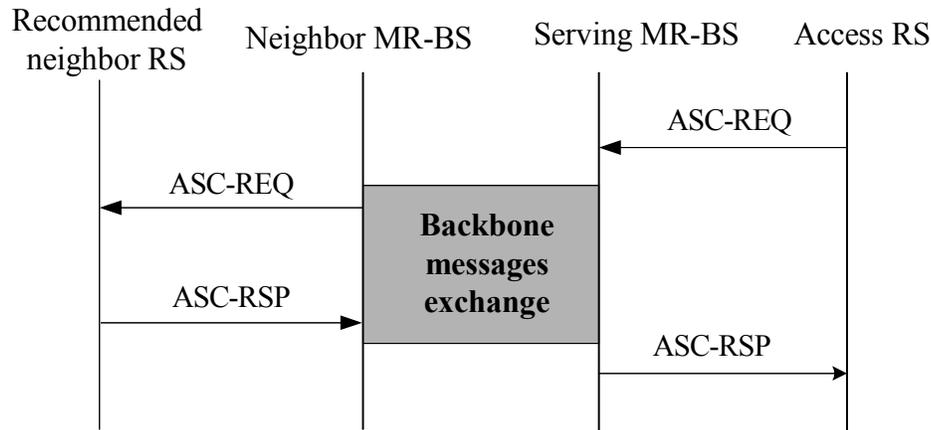


Figure 1-An example of association parameter acquisition in a distributed MR system

### 3.2 RNG-RSP information incorporation

During the scanning with association level 2, the MS is required to transmit the CDMA ranging code to the scanned neighbor station. Then the MS does not have to wait for RNG-RSP from the scanned neighbor station. Instead, in a centralized MR system the serving MR-BS shall incorporate the RNG-RSP information from the infrastructure stations into a single MOB\_ASC\_REP message. While in a distributed MR system, the access station may incorporate the RNG-RSP information from the infrastructure stations into a single MOB\_ASC\_REP message.

## 4. Proposed text

*[Insert new subclause 6.3.22.1.3.4]*

### 6.3.22.1.3.4 Association in an MR network

In a centralized MR system, the access station may relay the MOB\_SCN-REQ generated by the MR to the serving MR-BS and MOB\_SCN-RSP generated by the serving MR-BS to the MS. The association parameters acquisition procedure between the serving MR-BS and the neighbor MR-BS occurs over the backbone when the recommended neighbor stations are in different MR-cells. In a distributed MR system, when the access station of the MS is a RS, before the access RS transmits the MOB\_SCN-RSP unsolicited or in response to an MOB\_SCN-REQ sent by an MS, the access RS may exchange an ASC-REQ and ASC-RSP message with its serving MR-BS or with the recommended access RS in order to obtain the association parameters of the neighbor stations with association level 1 or 2 . MS scanning signal processing by the access RS is based on the capability negotiated during initial network entry of the RS.

The serving MR-BS may ask for the association parameters from the neighbor MR-BS via backbone network when the recommended neighbor stations are in different MR-cells. The neighbor MR-BS can obtain the association parameters of its subordinate recommended RSs and responds to the serving MR-BS in a distributed MR system.

When the recommended neighbor station is a RS and if the MR-BS does not know the allocation detail at the recommended access RS, the MR-BS may send a ASC -REQ message to its subordinate recommended

neighbor RS in order to request the association parameters (i.e. Rendezvous time, CDMA code, and Transmission\_opportunity offset). The recommended neighbor RS shall reply with a ASC -RSP message, indicating the association parameters allocated to the MS.

The serving MR-BS may coordinate the association parameters allocated by the neighbor stations to assure that the neighbor stations do not assign overlapping or too close in time to each other ranging regions. In an MR network with distributed scheduling, if access and recommended RSs can communicate directly over the 1-hop relay link between them, the access RS may coordinate the association parameters allocated by the neighbor stations.

In the case that association level 2 is chosen, in a centralized MR system the serving MR-BS shall incorporate the RNG-RSP information from the infrastructure stations into a single MOB\_ASC\_REP message. While in a distributed MR system, the access station may incorporate the RNG-RSP information from the infrastructure stations into a single MOB\_ASC\_REP message. 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**

An infrastructure station 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	
N_Recommended_Station_Index	8 bits	Number of neighboring stations to be associated.
for(j=0; j< N_Recommended_Station_Index; j++){		
Neighbor_Station_Index	48bits	Station MAC addresses
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.

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

**MS\_ID**

MS's MAC address

**N\_Recommended\_Station\_Index**

Number of neighboring stations to be associated..

**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**

An infrastructure station transmits this message to respond to the ASC -REQ message.

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>ASC-RSP_Message_format () {</u>	<u>=</u>	
<u>Management Message Type=TBD</u>	<u>8bits</u>	
<u>MS ID</u>	<u>48bits</u>	
<u>N_Recommended_Station_Index</u>	<u>8 bits</u>	<u>Number of neighboring stations to be associated..</u>
<u>For(j=0; j&lt; N_Recommended_Station_Index; j++){</u>		
<u>Neighbor_Station_Index</u>	<u>48 bits</u>	<u>Station MAC addresses.</u>
<u>Scanning Type</u>	<u>2 bits</u>	<u>0b00: Scanning with Association level 0;</u> <u>0b01: Scanning with Association level 1;</u> <u>0b10: Scanning with Association level 2;</u> <u>0b11: Reserved.</u>
<u>if (Scanning Type &gt; 0){</u>		
<u>Rendezvous time</u>	<u>8 bits</u>	

<u>CDMA code</u>	<u>8 bits</u>	
<u>Transmission_opportunity offset</u>	<u>8 bits</u>	
<u>}</u>		
<u>}</u>		
<u>Padding</u>	<u>Variable</u>	<u>If needed for alignment to byte boundary.</u>
<u>}</u>	<u>=</u>	

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

**MS\_ID**

MS's MAC address

**N\_Recommended\_Station\_Index**

Number of neighboring stations to be associated.

**Neighbor\_station\_Index**

Station MAC addresses

**Scanning Type**

Scanning Type allocated by the neighbor station to the MS.

**References**

- [1] IEEE 802.16mmr-06/002r1, "Draft P802.16j PAR and Five Criteria: Mobile Multi-hop Reply "
- [2] IEEE 802.16j-06/016r1, "Proposed Technical Requirements Guideline for IEEE 802.16 Relay TG "
- [3] IEEE 802.16j-06/017r2, "Table of Contents of Task Group Working Document "
- [4] IEEE C802.16j-07/082r1, "Overview of the proposal for MS MAC handover procedure in an MR Network,"