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Re:	IEEE 802.16j-06/027: "Call for Technical Proposals regarding IEEE Project P802.16j"	
Abstract	This document is to define Network Entry procedure in 6.3.9.16 of IEEE 802.16j-06/026 for relay station (RS) to join Multihop Relay network.	
Purpose	Adopt the text proposal in this document	
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RS Network Entry

Introduction

The purpose of this document is to define Network Entry procedure in 6.3.9.16 of IEEE 802.16j-06/026 for relay station (RS) to join Multihop Relay network.

Explanation of Problem

There are two scenarios of RS Network Entry in a Multihop Relay network. One is RS entering the network by communicating with MR-BS directly and the other is RS entering the network via another RS. In the two scenarios, modified Network Entry procedure is required that is depicted in the following sections.

Design Objectives

1. The Network Entry procedure shall support RS to join Multihop Relay network.
2. The Network Entry procedure should support RS to enter and register the Multihop Relay network via various RS modes.
3. The Network Entry procedure executed by the RS should be centralized controlled by the MR-BS.
4. The modifications to legacy Network Entry procedure should be minimized.
5. The mode of RS and associated parameters should be assigned during the Network Entry procedure.
6. The new network topology after joining an RS should be determined during the Network Entry procedure.

Proposed Remedy

Figure 1 depicts the proposed procedure for initialization of RS. We propose the following modifications such that the procedures of Network Entry and Initialization defined in IEEE 802.16-2004 and IEEE 802.16e-2005 could be adopted for RS to enter and register to a Multihop Relay network.

1. The MAC request & response messages defined in IEEE 802.16-2004 and IEEE 802.16e-2005 should be used between MR-BS and RS or RS and RS in the access link with modifications on parameters required for RS.
2. Relaying messages are defined to transport the information in the relay path required for completing the Network Entry procedures.
3. The phases of “Ranging & Automatic Adjustment” and “Negotiate Basic Capabilities” in Figure 1 should be modified for the Network Entry procedure with various RS modes. After RS completed the procedures of the two phases, the new network topology could be determined.

Based on the CDMA ranging code set used by RS, two approaches for determining network topology in the phases of “Ranging & Automatic Adjustment” and “Negotiate Basic Capabilities” are described as follows.

- ✓ If RS uses same CDMA initial ranging code set as MS, MR-BS cannot identify if a new node is MS or RS until the phase of “Negotiate basic capabilities”. Because MR-BS controls the network topology,

MR-BS should admit in this phase if the new RS can join the network and determine which RS the new RS should attach to.

- ✓ If RS uses distinct CDMA initial ranging code sets, MR-BS could determine the identity of the new node to be MS or RS in the phase of “Perform ranging”. As a result, MR-BS could apply different policies for initial network topology establishment in this step. For example, the serving MR-BS can configure an RS to be the endpoint of the relay link. When the RS receives a CDMA initial ranging code from a new RS, the RS could ignore the code right away.

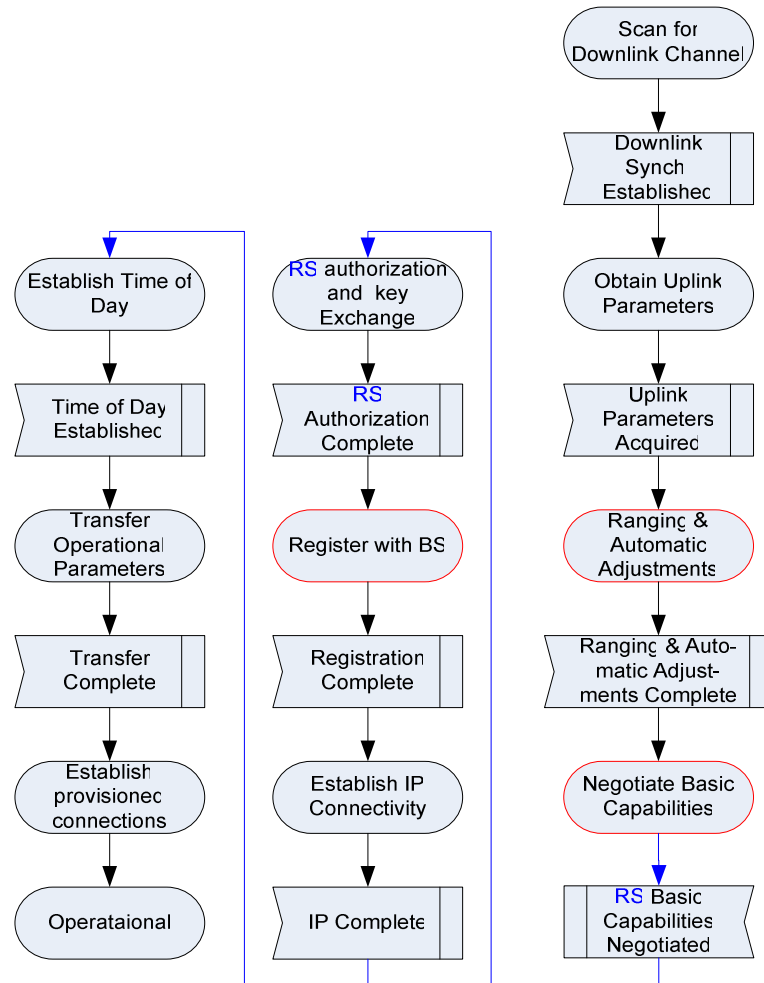


Figure 1: Network Entry Procedure for RS

Three examples are given in the following figures to illustrate the relaying messages and the modified procedure for RS performing ranging and negotiating basic capabilities with various modes of RSs.

Example 1: RS_1 joins the Multihop Relay network by communicating the MR-BS directly. The RS follows the same network entry procedure as MS. Figure 2 is given as an example to illustrate how RS performs ranging and negotiates basic capabilities with MR-BS.

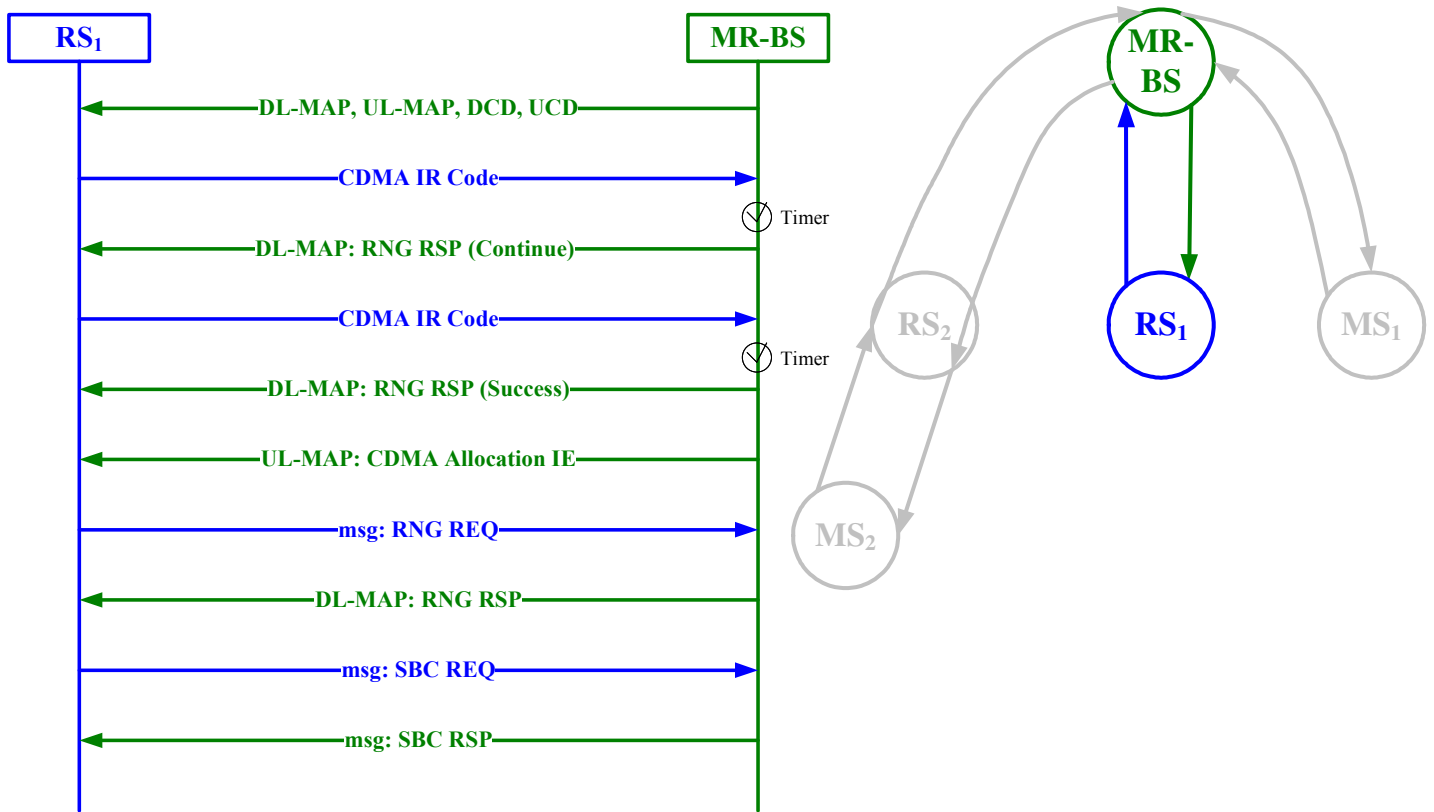


Figure 2: RS₁ joins the Multihop Relay network directly

Example 2: RS joins Multihop Relay network via another RS. In this example, only RS₁ can decode messages from the new RS and vice versa. Moreover, the MR-BS assigns the new RS to join the network via RS₁. Figure 3 is given as an example to show how the new RS performs initial ranging and negotiates basic capabilities with MR-BS via RS₁.

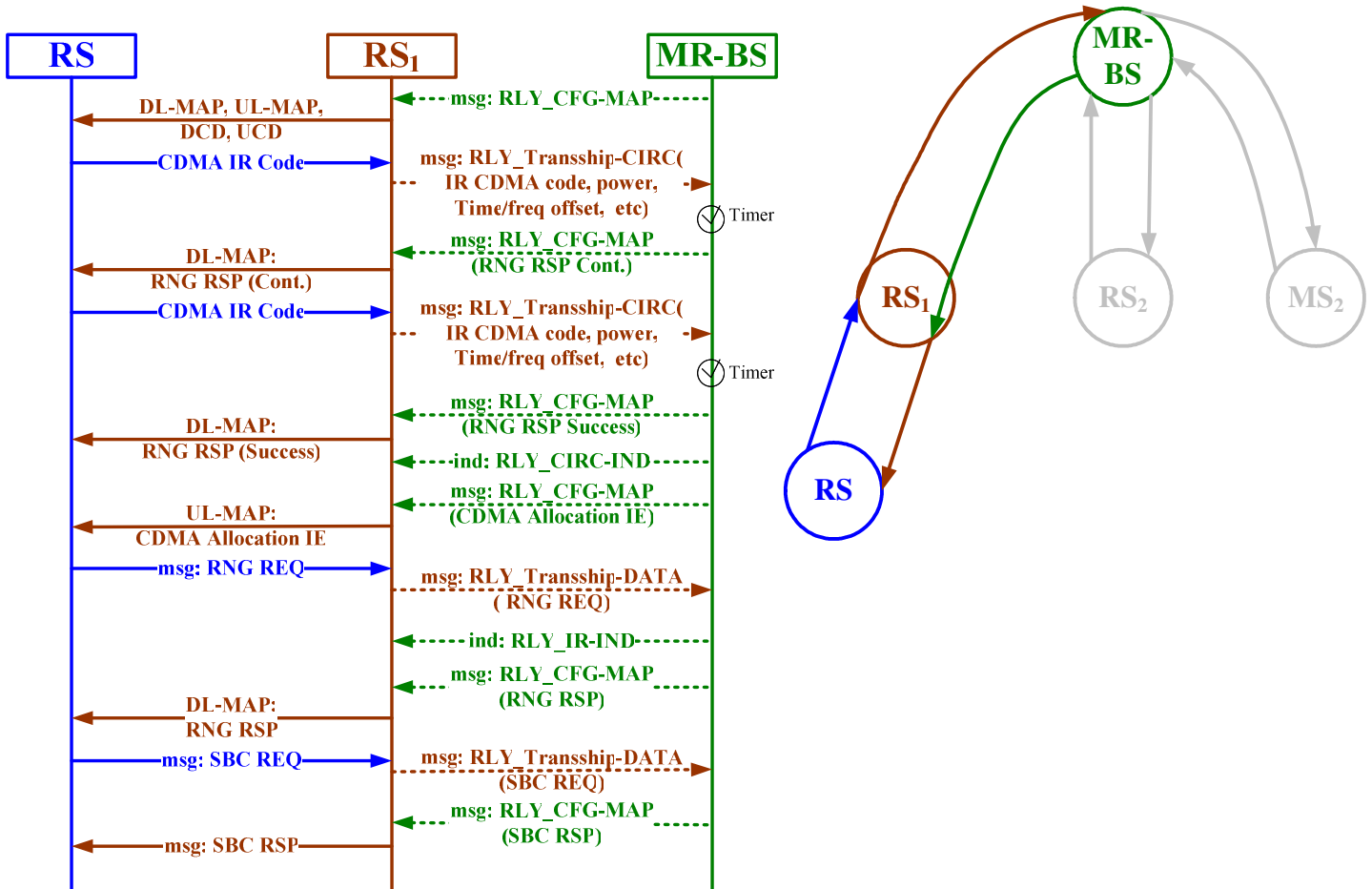


Figure 3: RS joins the Multihop Relay network via another RS

Example 3: RS joins the Multihop Relay network via another RS. In this example, both RS₁ and RS₂ can decode messages from the new RS and vice versa. The new RS can decode messages from MR-BS. Moreover, the MR-BS assigns the new RS to join the network via RS₁. The procedures of RS performing initial ranging and negotiating capabilities is depicted Figure 4.

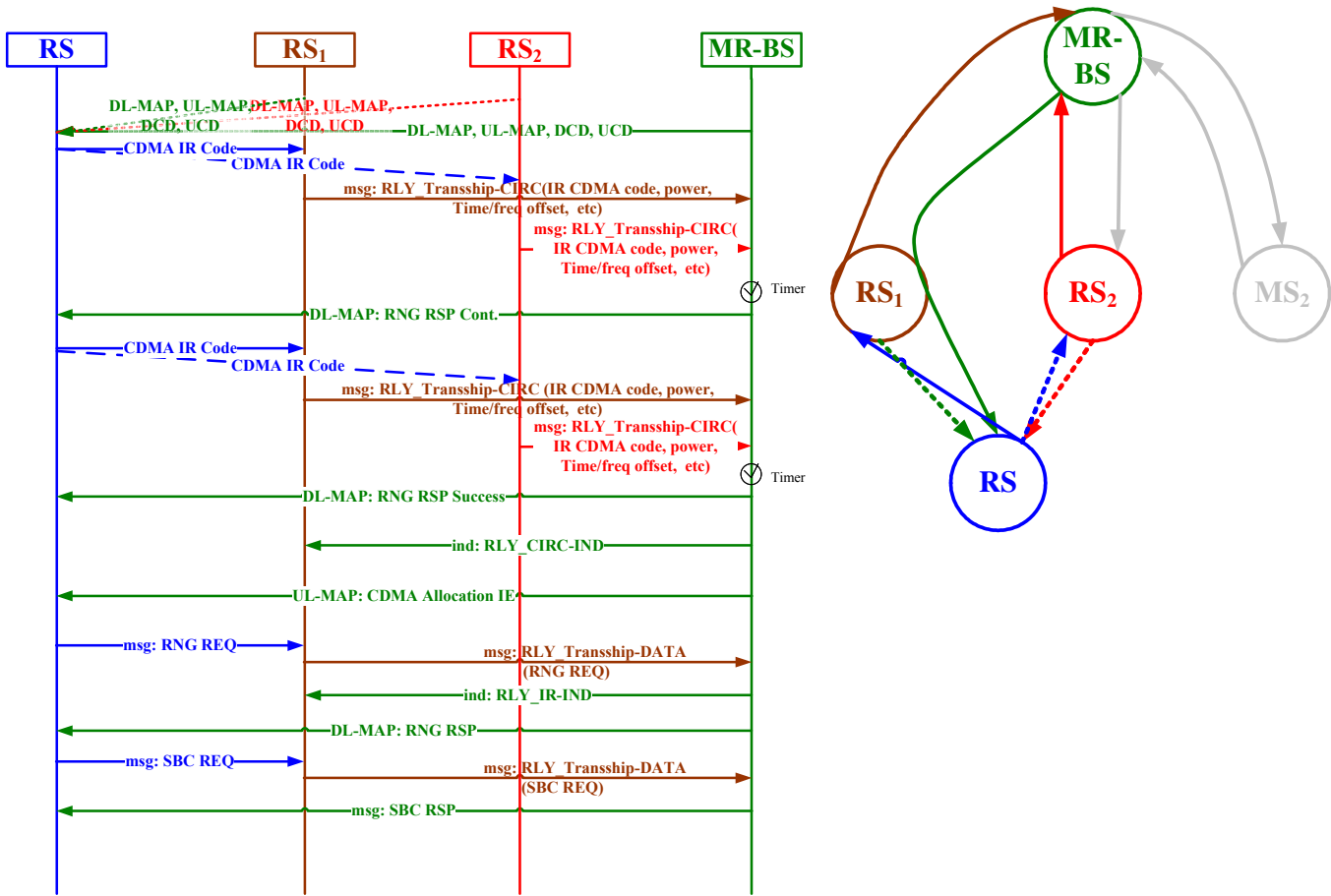


Figure 4: RS joins the Multihop Relay network via another RS

Text Proposal

1. Adopt the following text in “6.3.9.16 Support for network entry and initialization in relay mode”
2. Insert the following text in “6.3.2.3 MAC management messages”

6.3.9.16 Support for network entry and initialization in relay mode

6.3.9.16.1 Network entry and Initialization for MS

[see contribution C80216j-06/207]

6.3.9.16.2 Network entry and initialization for RS

Multihop Relay system shall support applicable procedures for entering and registering an RS to the network. After the procedures, the new multihop network topology after joining the RS should be determined. The procedure for initialization of RS is shown in Figure xxx which is similar to MS. The figure shows no error paths and is simply to provide an overview of the process. During the initialization process, the MAC request & response messages defined in IEEE 802.16-2004 and IEEE 802.16e-2005 should be used in access link with modifications on parameters required for RS, which are given in x.x.x.

The procedures can be divided into the following phases:

- a) Scan for downlink channel and establish synchronization with the MR-BS
- b) Obtain transmit parameters (from UCD message)
- c) Perform ranging
- d) Negotiate basic capabilities
- e) Authorize RS/SS and perform key exchange
- f) Perform registration
- g) Establish IP connectivity
- h) Establish time of day
- i) Transfer operational parameters
- j) Set up connections

Multihop network topology establishment after joining an RS should be completed in phases c) and d). The mode of RS and associated parameters should be assigned in phase f).

Implementation of phase e) is optional. This phase shall be performed if both RS and MR-BS support Authorization Policy. Implementation of phases g), h), and i) at RS is optional. These phases shall be performed only if the RS has indicated in the REG-REQ message that it is a managed RS.

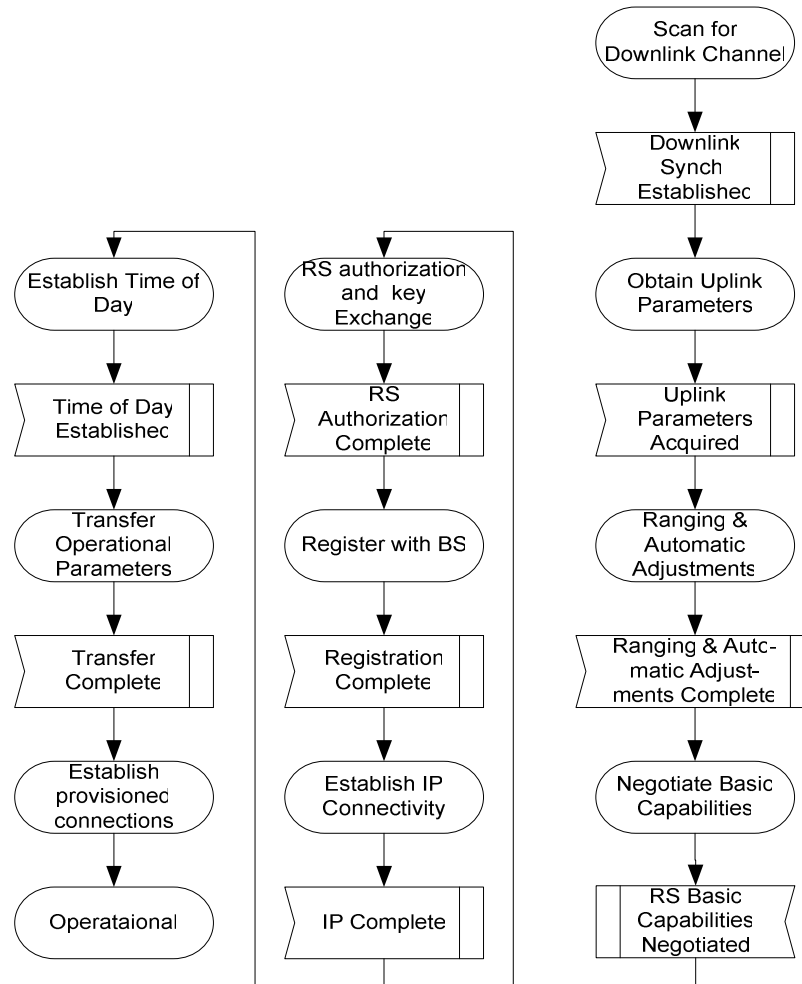


Figure xxx: Network Entry Procedure for RS

6.3.9.16.2.1 RS performs initial ranging

1. The MR-BS and/or RS associated with the MR-BS shall broadcast downlink synchronization and uplink transmission parameters.
2. The new RS, after acquiring downlink synchronization and uplink transmission parameters, shall choose randomly a Ranging Slot (with the use of a binary truncated exponent algorithm to avoid possible re-collisions) at the time to perform the ranging, then it chooses randomly a Ranging Code form the assigned Ranging Code Sets and accordingly sends a CDMA ranging request.
3. After an associated RS received the CDMA ranging request in access link, the RS should send RLY Transship-CIRC message to the serving MR-BS through the relay path, which includes the CDMA ranging request and measurements on the CDMA ranging request (e.g., time, power, and possibly frequency offset).
4. Upon receiving RLY Transship-CIRC message(s) from associated RS(s) and/or receiving the CDMA ranging request from the new RS directly, the MR-BS should select one of associated RS or itself to broadcast the Ranging Response message. In case that MR-BS selects an RS to be the candidate RS, the MR-BS should send RLY_CFG-MAP message to the candidate RS, which may include the associated adjustments for ranging. Afterward, the candidate RS shall broadcast a Ranging Response message. Otherwise, the MR-BS should broadcast a Ranging Response message by itself. The Ranging Response message advertises the received Ranging Code as well as the ranging slot (OFDMA symbol number, subchannel, etc.) where the CDMA Ranging code has been identified. This information is used by the new

- RS that sent the CDMA ranging code to identify the Ranging Response message that corresponds to its ranging request. The Ranging Response message contains all the needed adjustment (e.g., time, power, and possibly frequency corrections) and a status notification.
5. Upon receiving a Ranging Response message with continue status, the new RS shall continue the ranging process as done on the first entry with ranging codes randomly chosen from the Initial Ranging domain sent on the Periodic Ranging region.
 6. If the MR-BS receives an RLY Transship-CIRC message that triggers an RNG-RSP message with success status, the MR-BS shall use RLY CIRC-IND message to notify the candidate RS that the RS Ranging Code is accepted and the MR-BS should send RLY CFG-MAP message (include the information of CDMA Allocation IE) to candidate RS. Afterward, the candidate RS broadcasts the CDMA Allocation IE to provide BW allocation such that the new RS could send an RNG-REQ message.
 7. If the MR-BS receives an initial-ranging CDMA code that results in sending an RNG-RSP message with success status, the MR-BS shall broadcast CDMA Allocation IE to provide BW allocation such that the new RS could send an RNG-REQ message.
 8. After the candidate RS received a RNG-REQ message in access link, the candidate RS shall transport the RNG-REQ message to the MR-BS through the relay path.
 9. When the MR-BS received the transported RNG REQ message that triggers a RNG RSP message with success status, the MR-BS shall use RLY IR-IND message to notify the candidate RS that the RNG REQ message is accepted and the MR-BS send RLY CFG-MAP message (include the information of RNG RSP) to the candidate RS. Afterward, the candidate RS shall broadcast the RNG RSP message to the new RS.
 10. Initial ranging process is completed after the new RS receiving RNG-RSP message, which includes a valid basic CID (following a RNG-REQ transmission on a CDMA Allocation IE). If this RNG-RSP message includes 'continue' indication, the ranging process should be continued using the periodic ranging mechanisms.
 11. The timeout required for the new RS to wait for RNG-RSP message, following or not following CDMA Allocation IE, is defined by T3.
 12. Using the OFDMA ranging mechanism, the periodic ranging timer is controlled by the new RS, not the MR-BS and/or associated RS(s).

6.3.2.3 MAC management messages

[Insert the following text into this section]

Add the columns into Table 14 as indicated.

Table 14—MAC Management messages

<u>Type</u>	<u>Message name</u>	<u>Message description</u>	<u>Connection</u>
<u>69</u>	<u>RLY_CFG-MAP</u>	<u>MR-BS configure associated RS for RS broadcasting</u>	<u>Broadcast/Multicast/Basic</u>
<u>70</u>	<u>RLY_Transship-CIRC</u>	<u>RS transport RS/MS CDMA initial ranging code to associated MR-BS. Its IE shall include IDcell of RS that originates this message. In IEEE802.16-2005, IDcell is defined as 5-bit integer.</u>	<u>Basic</u>
<u>71</u>	<u>RLY_Transship-DATA</u>	<u>RS transport RS/MS data to associated MR-BS. Its IE shall include IDcell of RS that originates this message. In IEEE802.16-2005, IDcell is defined as 5-bit integer.</u>	<u>Primary</u>
<u>72</u>	<u>RLY_CIRC-IND</u>	<u>MR-BS notify candidate RS to accept the new RS/MS CDMA initial ranging code</u>	<u>Basic</u>
<u>73</u>	<u>RLY_IR-IND</u>	<u>MR-BS notify candidate RS to accept the new RS/MS</u>	<u>Basic</u>

Relay station Configure Map (RLY_CFG-MAP) message

[TBD]

Relay station Transship CDMA Initial Ranging Code (RLY_Transship-CIRC) message

[TBD]

Relay station Transship Date (RLY_Transship-DATA) message

[TBD]

Relay station CDMA Initial Ranging Code Indication (RLY_CIRC-IND) message

[TBD]

Relay station Initial Ranging Indication (RLY_IR-IND) message

[TBD]

Appendix