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| Re: | This contribution is response to call for technical proposal (IEEE 802.16j-07/007r2). |
|---|---|
| Abstract | This document proposes how to assign Management CID to RS and relayed MS. |
| Purpose | Discuss and adapt proposed text and message format. |
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# Management CID allocation

## Introduction

This contribution proposes a method of management CID assignment for mobile station (MS) through an RS in a ~~mobile~~ multihop relay (~~M~~MR) network.

## Background

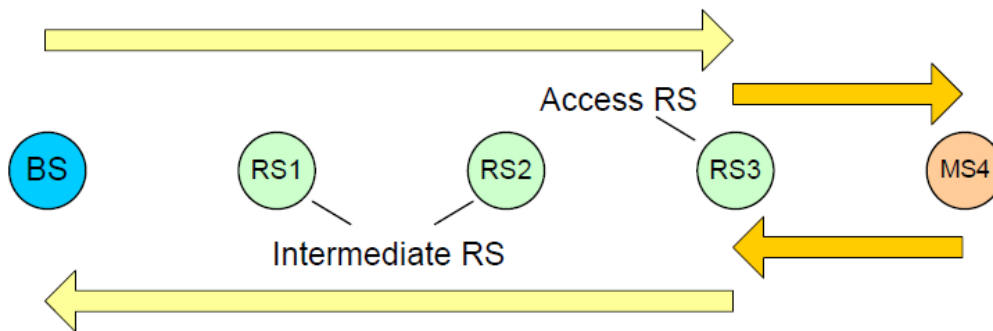Figure 1 shows reference model of IEEE802.16j.



Figure 1 Reference Model of Network Entry for IEEE802.16j

Base station (MR-BS) and mobile station (MS) communicate through one or more relay stations (RSs). All RSs are assumed to transmit preamble and control messages.

In a simple RS case, RS only forwards messages and data with no processing. It is expected that many messages are exchanged between MR-BS and MS via RSs especially ~~in~~ during network entry process. One method to reduce the round-trip time of the message transmission between MR-BS and MS is pre-~~assignment~~ allocation of management CIDs to an access RS. By using the CID pre-~~assignment~~allocation, some message ~~exchanges~~ can be ~~done~~ exchanged between the access RS and MS without going back to BS.~~-~~
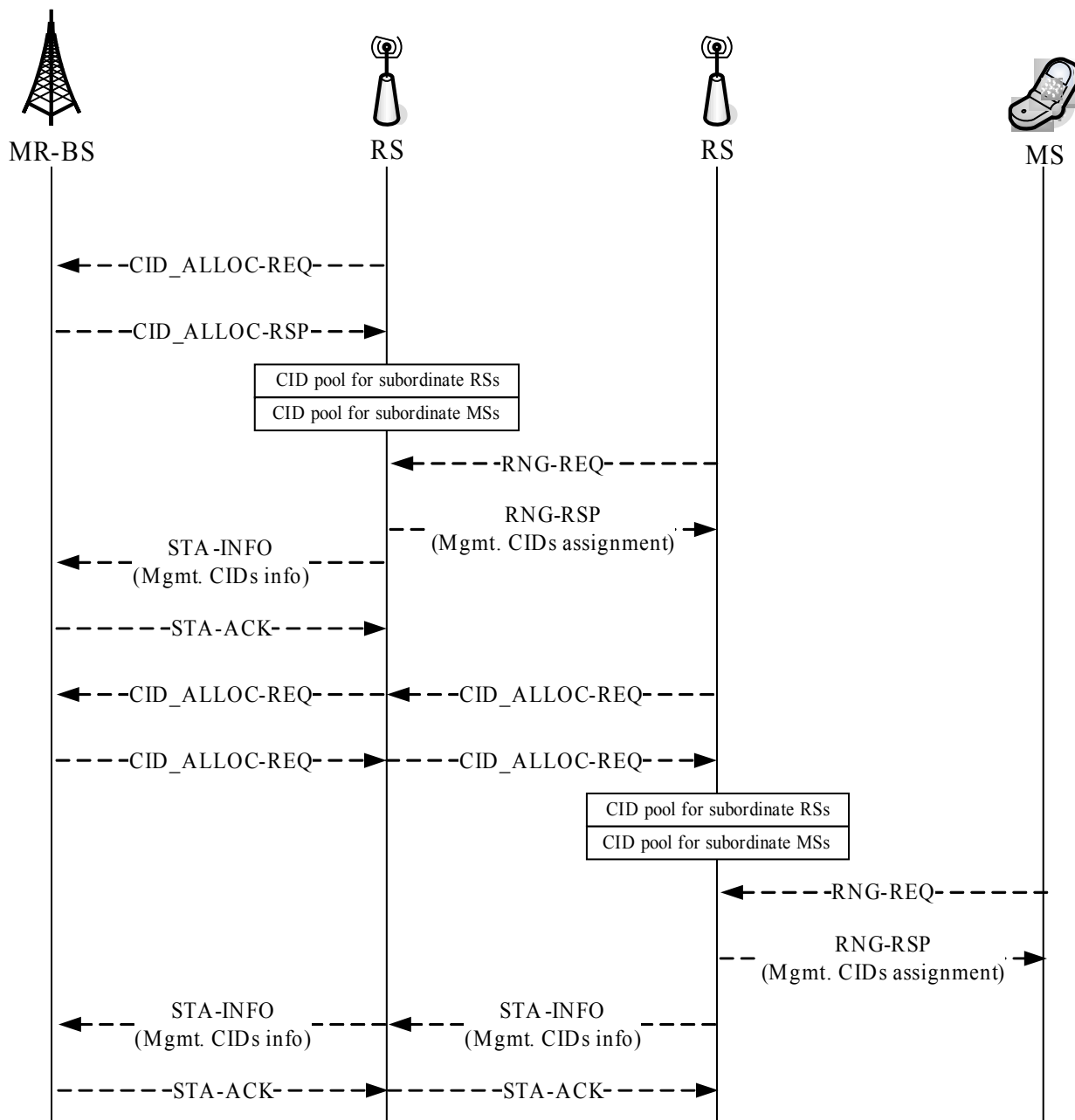
## Proposed method

As an optional operation, we propose to pre-~~assign~~ allocation of CIDs to RSs.
MR-BS can assign multiple management CIDs to RS ~~during RS initial ranging process~~ by using ~~RNG-REQ/RSP~~CID-ALLOC-REQ/RSP messages. If management CID number is random, all the 16 bits CID numbers should be informed. It results in a long management message. To reduce the message length, consecutive CID number can be used. In that case, only two 16 bits CIDs of the first and last CID numbers are enough to be exchanged.

Additionally, systematic range assignment of RSs may provide further benefit [3]. Systematic range assignment means each superordinate RS has a range as the superset of the union of CIDs of all its subordinate RSs. Systematical CID allocation could embed network topology into CIDs to help RSs to find routing paths without storing all CIDs of subordinate RSs in the routing table.  The management CID may be divided into two ranges; one is for MS and other one is for RS.

RS also can assign ~~these~~ CIDs or CID range to its subordinate node (MS or RS) on behalf of superordinate node (MR-BS or RS) during ~~ranging~~ network entry process or at any time whenever needed. In this process, although the management CIDs are assigned by RS, the MR-BS can manage the CID allocation. Because the RS notifies its superordinate node the information of the CID that the RS has

assigned to the MS, Example of these sequences is shown in figure 2. Since the number of these sequence is $2 \times n_{hops} \times number\ of\ MS$, this method contributes to effective use of network resource.

MR-BS                RS                 RS                MS

◄- - -CID_ALLOC-REQ- - - -

- - - -CID_ALLOC-RSP- - - -►

| CID pool for subordinate RSs |
| CID pool for subordinate MSs |

◄- - - - - RNG-REQ- - - - -

RNG-RSP
(Mgmt. CIDs assignment) ►

◄- - - STA-INFO
(Mgmt. CIDs info)

- - - - -STA-ACK- - - - -►

◄- -CID_ALLOC-REQ- - - ◄- - -CID_ALLOC-REQ- - -

- - -CID_ALLOC-REQ- - ►- - -CID_ALLOC-REQ- - ►

| CID pool for subordinate RSs |
| CID pool for subordinate MSs |

◄- - - - -RNG-REQ- - - - -

RNG-RSP
(Mgmt. CIDs assignment) ►

◄- - STA-INFO                STA-INFO
(Mgmt. CIDs info)           (Mgmt. CIDs info)

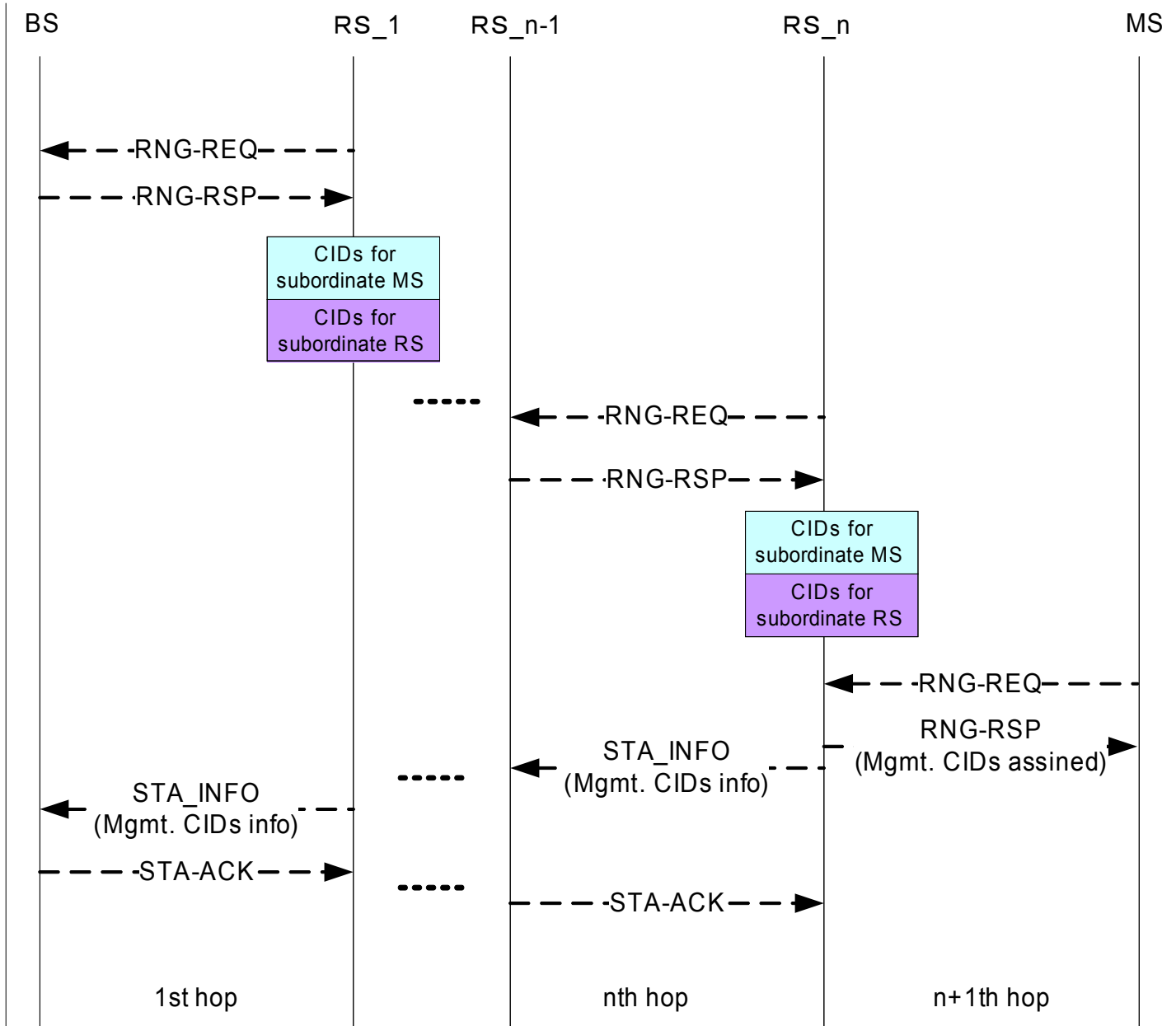- - - -STA-ACK- - - - ►- - - -STA-ACK- - - - ►

5

Figure 2 Management CIDs allocation and assignment

## Text to be inserted into standard

**6.3.2.3          MAC management messages**

**6.3.2.3.5       Ranging request (RNG-REQ) message**

Insert the following text at the end of the 6.3.2.3.5:

The following TLV parameter shall be included in the RNG-REQ message when transmitted during RS initial entry to the network. Conventional MS ignores the parameter.

————

————        Requested number of management CID for MS
————        Requested number of management CID for RS

**6.3.2.3.6       Ranging response (RNG-RSP) message**

Insert the following text at the end of the 6.3.2.3.6:

~~The following TLV parameter shall be included in the RNG-RSP message when transmitted during RS initial entry to the network. The MR-BS could assign the range of RSs and MSs systematically or non-systematically. Conventional MS ignores the parameter.~~

~~————    CID allocation method~~
~~————    Range of management CID for MS~~
~~————    Range of management CID for RS~~

*Insert new subclause 6.3.2.3.65 through 6.3.2.3.68:*

**6.3.2.3.~~XX~~65 RS CID Allocation Request  (CID_ALLOC-REQ) message**

The CID_ALLOC-REQ message shall be transmitted by an RS at any time to make request for pre allocation of primary and basic CIDs for subordinate RSs and MSs. The message format is shown in Table XX.

Table XX CID_ALLOC-REQ message format

| Syntax | Size | Note |
|---|---|---|
| CID_ALLOC-REQ_Message_Format() { | | |
| Management Message Type (TBD) | 8 bits | |
| N_Code | 16 bits | Number of primary and basic CIDs requested |
| STA_IND | 1 bits | To identify the request for subordinate MS or RS<br>0: MS<br>1: RS |
| } | | |

Basic CID (in the MAC header)
The CID in the MAC header is the Basic CID for this RS, as assigned in the RNG-RSP message.

**6.3.2.3.XX 66 RS CID Allocation  Response  (CID_ALLOC-RSP) message**

The CID_ALLOC-RSP message shall be transmitted by the MMR-BS in response to the CID_ALLOC-REQ message from RS or at any time to pre-allocate primary and basic CIDs for MS. MMR-BS shall transmit the same message to an RS to de-allocate primary and basic CIDs previously allocated to an RS. The message format is shown in Table XX.

Table XX CID_ALLOC-RSP message format

| Syntax | Size | Note |
|---|---|---|
| CID_ALLOC-RSP_Message_Format() { | | |
| Management Message Type (TBD) | 8 bits | |
| Alloc_IND | 1 bit | 1= Allocation<br>0=De-allocation |
| CID_Alloc_method | 3 bits | 0÷=contiguous method<br>1~7÷=reserved |
| If (Alloc_IND= =1) { | | |
| If (CID_Alloc_method = =0) { | | |
| Start | 16 bits | Starting point of the CID number |
| N_Code | 16 bits | Total number of CIDs allocated for basic and primary CIDs |
| } | | |
| } | | |
| Else if (Alloc_IND = =0) { | | |
| If (CID_Alloc_method = =0) { | | |
| Start | 16 bits | Starting point of the CID number |
| N_Code | 16 bits | Total number of CIDs de-allocated |
| } | | |
| } | | |
| } | | |

Basic CID (in the MAC header)
The CID in the MAC header is the Basic CID for this RS, as appears in the CID_ALLOC-REQ
message

### 6.3.2.3. ~~XX~~67 Station Information (STA-INFO) message

The STA-INFO message shall be transmitted by the RS to identify a new station (MS or RS) is ready to
enter to the network. RS shall include MS's information along with assigned primary and basic CIDs. The
message format is shown in Table XX.

Table XX: STA_INFO message format

| Syntax | Size | Note |
|---|---|---|
| STA-INFO_Message_Format() { | | |
| Management Message Type (TBD) | 8 bits | |
| MAC ID | 48 bit | Station's MAC address |
| Primary management CID | 16 bits | Primary management CID assigned from RS to the network entering station (MS/RS) |
| Basic CID | 16 bits | Basic CID assigned from RS to the station (MS/RS) |
| Message number | 4 bits | Message identification number in case of multiple messages |
| } | | |
| TLV Encoded Information | variable | |
| } | | |

Basic CID (in the MAC header)
The CID in the MAC header is the Basic CID for this RS, as assigned in the RNG-RSP message.

### 6.3.2.3.~~XX~~68 Station Information Acknowledge (STA-ACK) message

The STA-ACK message shall be transmitted in response to STA-INFO by the MR-BS to notify the RS
that new station's (MS/RS) information is received successfully. The message format is shown in Table XX.

Table XX STA-ACK message format

| Syntax | Size | Note |
|---|---|---|
| STA-ACK_Message_Format() { | | |
| Management Message Type (TBD) | 8 bits | |
| Message number | 4 bits | Message identification number in case of multiple messages |
| TLV Encoded Information | variable | |
| } | | |

Basic CID (in the MAC header)
The CID in the MAC header is the Basic CID for this RS, as appears in the STA-INFO message

### 6.3.9        Network entry and initialization

**6.3.9.16**          **Support for network entry**
**6.3.9.16.1**       **MS network entry procedures in transparent RS systems**
**6.3.9.16.2**       **MS network entry procedures in non-transparent RS systems**
**6.3.9.16.3**       **RS network entry procedures in transparent RS systems**
**6.3.9.16.4**       **RS network entry procedures in non-transparent RS systems**

*Insert new subclause 6.3.9.16.5:*
**6.3.9.16.5**       **Optional network entry procedure with localized RS**

**6.3.9.16. 5.1     CID pre-assignment during RS network entry procedureallocation to localized RS**

This RS network entry process is almost same as described in 6.3.9.16.2.1, except that the MR-BS or RS assigns the CID to its subordinate nodes.

The MR-BS may assign allocate a part of management CID range systematically or non-systematically to its subordinate RS during ranging process or by using CID_ALLOC-REQ/RSP messages at any time whenever needed. Systematic range assignment means each superordinate RS has a range as the superset of the union of CIDs of all its subordinate RSs. Systematical CID allocation could embed network topology into CIDs to help RSs to find routing paths without storing all CIDs of subordinate RSs in the routing table.
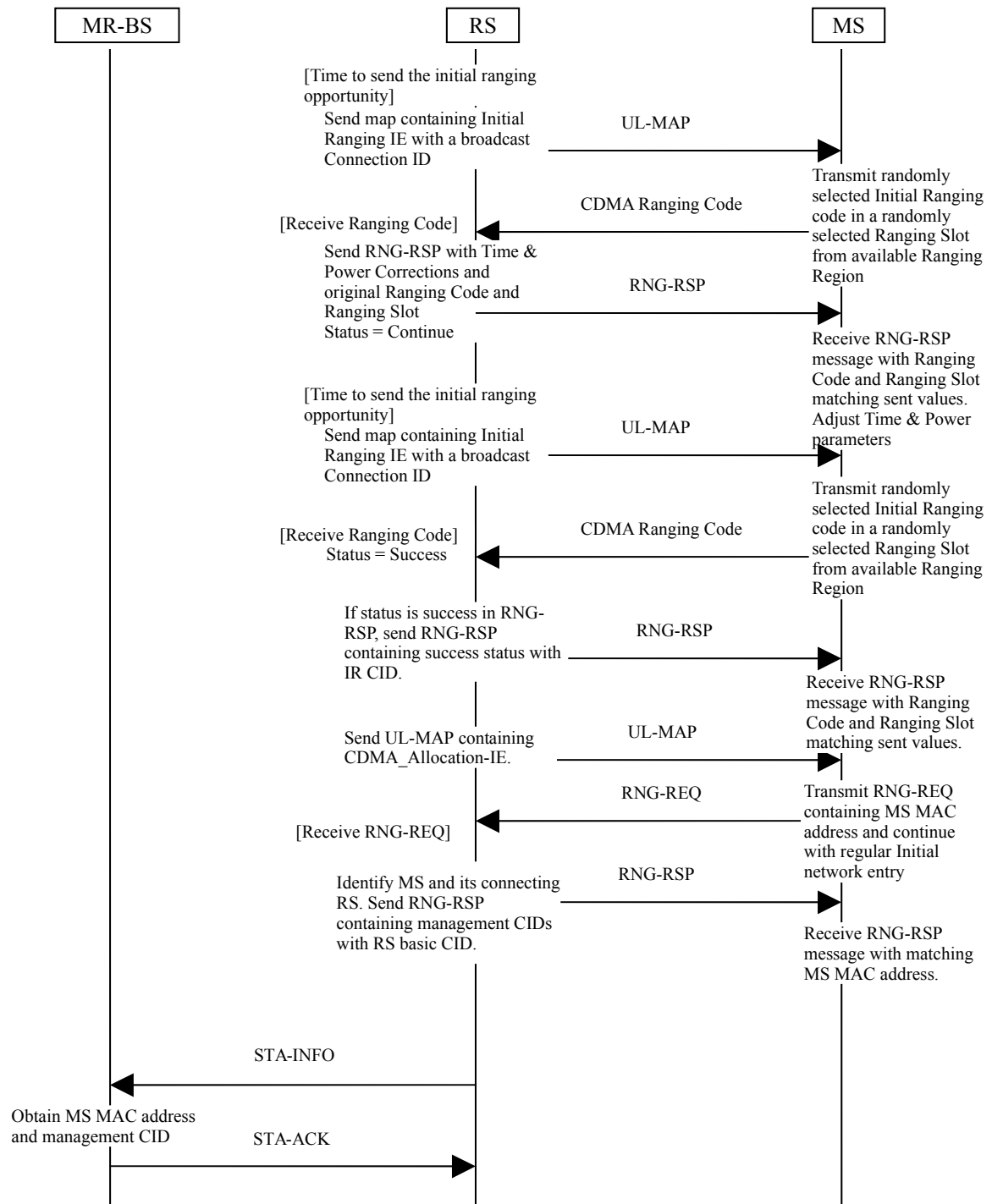
~~Figure xxx Ranging and automatic adjustments procedure with optional availability check at RS in MR mode~~

### 6.3.9.16.5.2    MS network entry procedure for localized non-transparent RS

This MS network entry process is almost same as described in 6.3.9.16.2.1, except that RS is assigned range of management CIDs by its super-ordinate node in advance. This section states that the RS ~~may~~ assigns the management CIDs to its subordinate nodes (MS or RS) during initial ranging process. RS may pre-allocate CID range to subordinate RS using CID_ALLOC-REQ/RSP messages on behalf of the MR-BS ~~during the ranging process of these nodes or at any time whenever needed~~.

When the time & power correction is finished between RS and MS, and the RS receives the RNG-REQ containing MS MAC address, the RS may reply the RNG-RSP containing the management CID that is assigned by the RS. In addition, the RS may inform the BS that a new station (MS or RS) is ready to enter to the network using STA-INFO/ACK message.

After assigning the basic and primary management CID to a MS, the MS and MR-BS continue network entry process as described in the 6.3.9.7 through 6.3.9.13 using MS's management CIDs. The RS shall relay management messages between them.
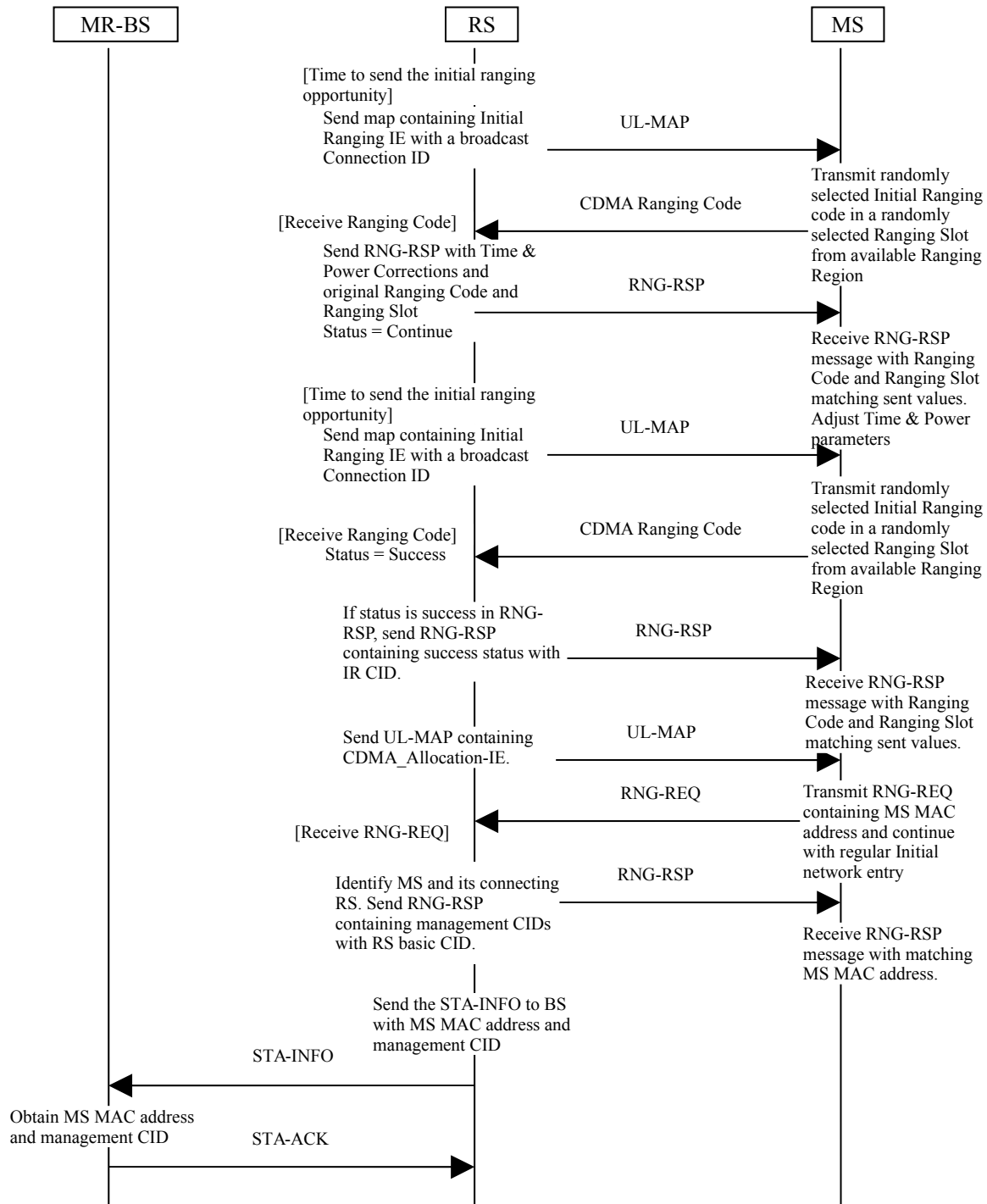
Figure xxx Ranging and automatic adjustments procedure with optional availability check at RS in MR mode

## 11.5          RNG-REQ message encodings

Insert the following entries into Table 364:

Table 364 – RNG-REQ message encodings

| Name | Type (1 byte) | Length | Value (variable-length) | PHY Scope |
|---|---|---|---|---|
| Requested number of management CID for MS | xx | 1 | The number of management CID for subordinate MS | OFDMA |
| Requested number of management CID for RS | xx | 1 | The number of management CID for subordinate RS | OFDMA |

## 11.6          RNG-RSP management message encodings

Insert the following entries into Table 367:

Table 367 – RNG-RSP message encodings

| Name | Type (1 byte) | Length | Value (variable-length) | PHY Scope |
|---|---|---|---|---|
| CID allocation method | xx | 1 | Used to indicate the CID allocation method of RSs 0: contiguous method | OFDMA |
| Range of management CID for RS | xx | 4 | If CID range allocation method==0: Byte#0-1: start number of CID Byte#2-3: number of CIDs | OFDMA |
| Range of management CID for MS | xx | 4 | Byte#0-1: start number of CID Byte#2-3: number of CIDs | OFDMA |

## Reference

[1] IEEE C802.16j-06/154, "Network entry procedure for MS in 802.16j"
[2] IEEE C802.16j-06/281r3, "Management CID allocation"
[3] IEEE C802.16j-07/241, "Systematic CID Allocation and Relay Path Configuration"