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Project IEEE 802.16 Broadband Wireless Access Working Group <<http://ieee802.org/16>>

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Title Management CID allocation

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| <p>Source(s) Kenji Saito, <del>Takashi Inoue</del><br/> KDDI <del>R&amp;D Laboratories Inc. Corporation</del><br/> <u><a href="#">3-10-10, Iidabashi, Chiyoda-ku, Tokyo</a></u><br/> <u><a href="#">102-8460 Japan</a></u><br/> <del>Hikarino-oka 7-1, Yokosuka, Kanagawa 239-0847, Japan</del></p> | <p>Voice: +81 <del>46-847-634780 5061</del><br/> <u><a href="#">9967</a></u><br/> Fax: <del>+81 46 847 0947</del><br/> <u><a href="mailto:kenjisaito@kddilabs.jp">kenjisaito@kddilabs.jp</a></u><br/> <u><a href="mailto:kenjisaito@kddi.com">kenjisaito@kddi.com</a></u></p> |
| <p>Sungjin Lee, Hyunjeong Kang, HyoungKyu Lim<br/> Samsung Electronics</p>  | <p>Voice: +82 31 279 5248<br/> Fax: +82 31 279 5130<br/> <u><a href="mailto:steve.lee@samsung.com">steve.lee@samsung.com</a></u></p>  |
| <p>Mohsin Mollah, <del>Masahito Asa</del><br/> Motorola Japan Ltd<br/> 3-20-1, Minami-Azabu,<br/> Minato-ku Tokyo 106-8573 Japan</p>  | <p>Voice: +81 3 5424 3209<br/> <u><a href="mailto:mohsin@motorola.com">mohsin@motorola.com</a></u></p>  |
| <p>Aik Chindapol<br/> Jimmy Chui<br/> Hui Zeng<br/> Siemens Corporate Research<br/> Princeton, NJ, 08540, USA</p>   | <p>Voice: +1 609 734 3364<br/> Fax: +1 609 734 6565<br/> Email: <u><a href="mailto:aik.chindapol@siemens.com">aik.chindapol@siemens.com</a></u></p>   |
| <p>Teck Hu<br/> Siemens Networks<br/> Boca Raton, FL 33431, USA</p>   |   |
| <p>Yuan-Ying Hsu<br/> Telcordia Applied Research Center Taiwan Co.,<br/> Taipei, Taiwan</p>   | <p><u><a href="mailto:yyhsu@tarc-tw.research.telcordia.com">yyhsu@tarc-tw.research.telcordia.com</a></u></p>  |
| <p>Jen-Shun Yang, Tzu-Ming Lin, Wern-Ho Sheen,<br/> Fang-Ching Ren, Chie Ming Chou, I-Kang Fu<br/> Industrial Technology Research Institute (ITRI)/<br/> National Chiao Tung University (NCTU), Taiwan<br/> 195, Sec. 4, Chung Hsing Rd.<br/> Chutung, Hsinchu, Taiwan 310, R.O.C.</p>              | <p><u><a href="mailto:jsyang@itri.org.tw">jsyang@itri.org.tw</a></u></p>  |
| <p><u><a href="#">Masato Okuda</a></u><br/> <u><a href="#">Fujitsu Laboratories Ltd.</a></u><br/> <u><a href="#">Kamikodanaka 4-1-1,</a></u><br/> <u><a href="#">Kawasaki, 211-8588, Japan</a></u></p>  | <p>Voice: +81-44-754-2811<br/> Fax: +81-44-754-2786<br/> <u><a href="mailto:okuda@jp.fujitsu.com">okuda@jp.fujitsu.com</a></u></p>  |
| <p><u><a href="#">Yuefeng Zhou</a></u><br/> <u><a href="#">Fujitsu Laboratories of Europe Ltd</a></u><br/> <u><a href="#">Hayes Park Central, Hayes End Road, Hayes,</a></u></p>  | <p>Voice: +44 (0) 20 8573 4444<br/> Fax: +44 (0) 20 8606 4539</p> <hr/>   |

Middlesex, UB4 8FE, UKYuefeng.zhou@uk.fujitsu.com

Wen Tong, G.Q. Wang, Hang Zhang, Peiyong Zhu,  
Mo-Han Fong, David Steer, Gamini Senarath,  
Derek Yu  
Nortel  
3500 Carling Avenue  
Ottawa, Ontario K2H 8E9

Voice: 1-613-763-1315  
[mailto:wentong@nortel.com]

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| Re: | This contribution is response to call for technical <u>proposal-comments</u> (IEEE 802.16j-07/ <del>007r</del> 2013). |
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| Abstract | This document proposes how to assign Management CID to RS and relayed MS. |
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| 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 (MMR) network.

### Background

Figure 1 shows reference model of IEEE802.16j.

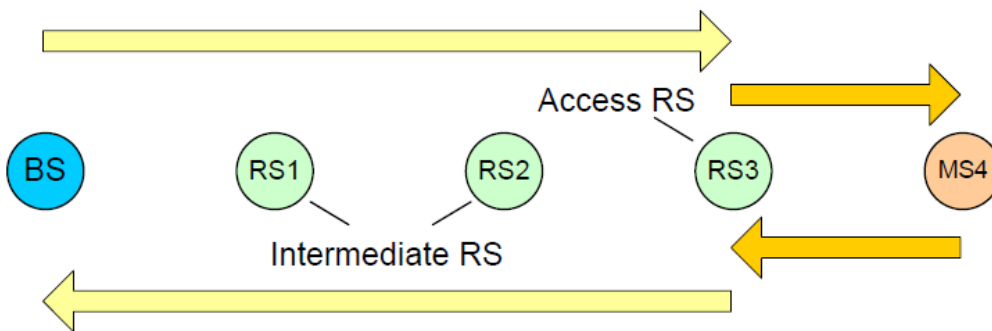


Figure 1 Reference Model of Network Entry for IEEE802.16j

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

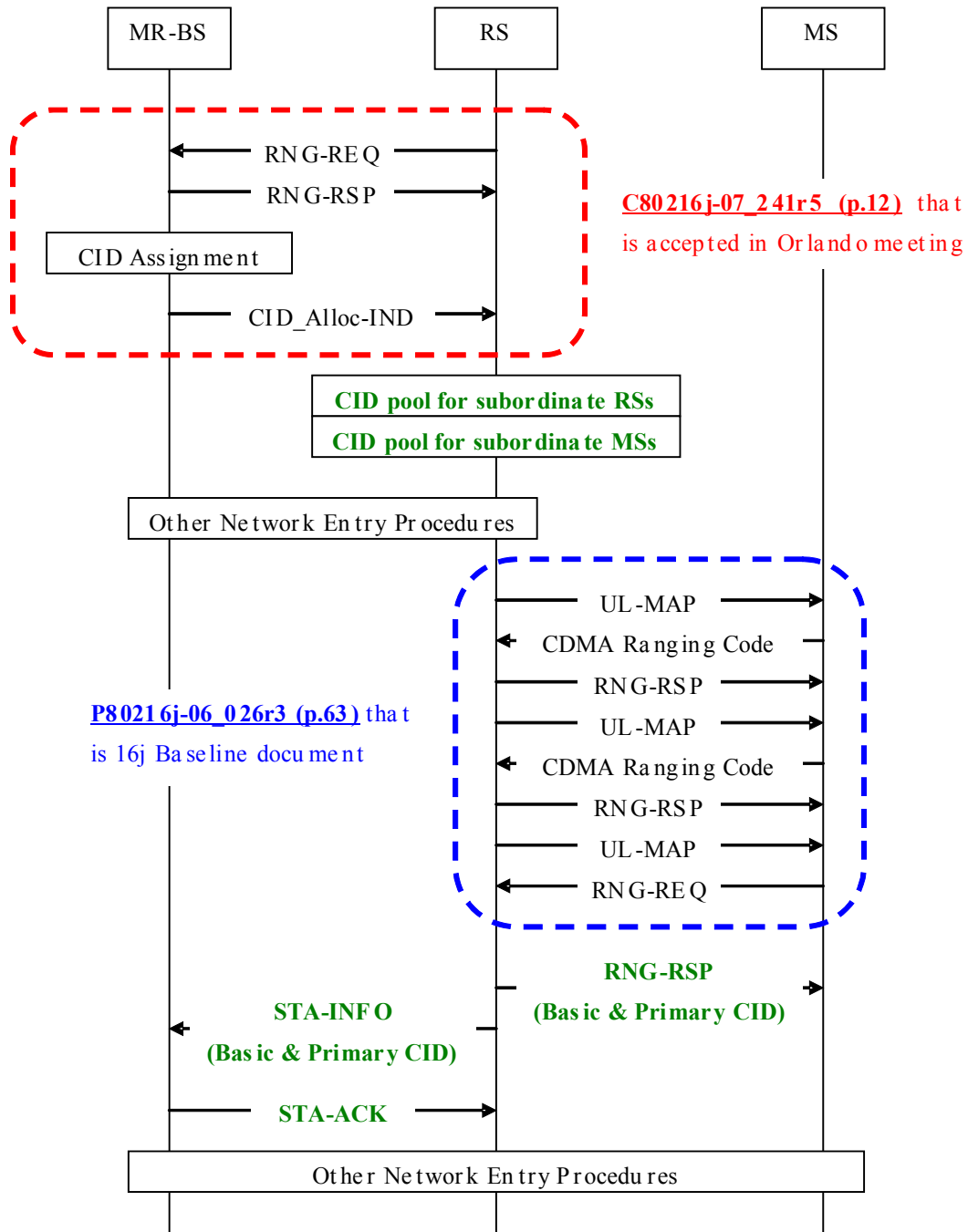
As an optional operation, we propose to pre-assign-allocation of CIDs to RSs.

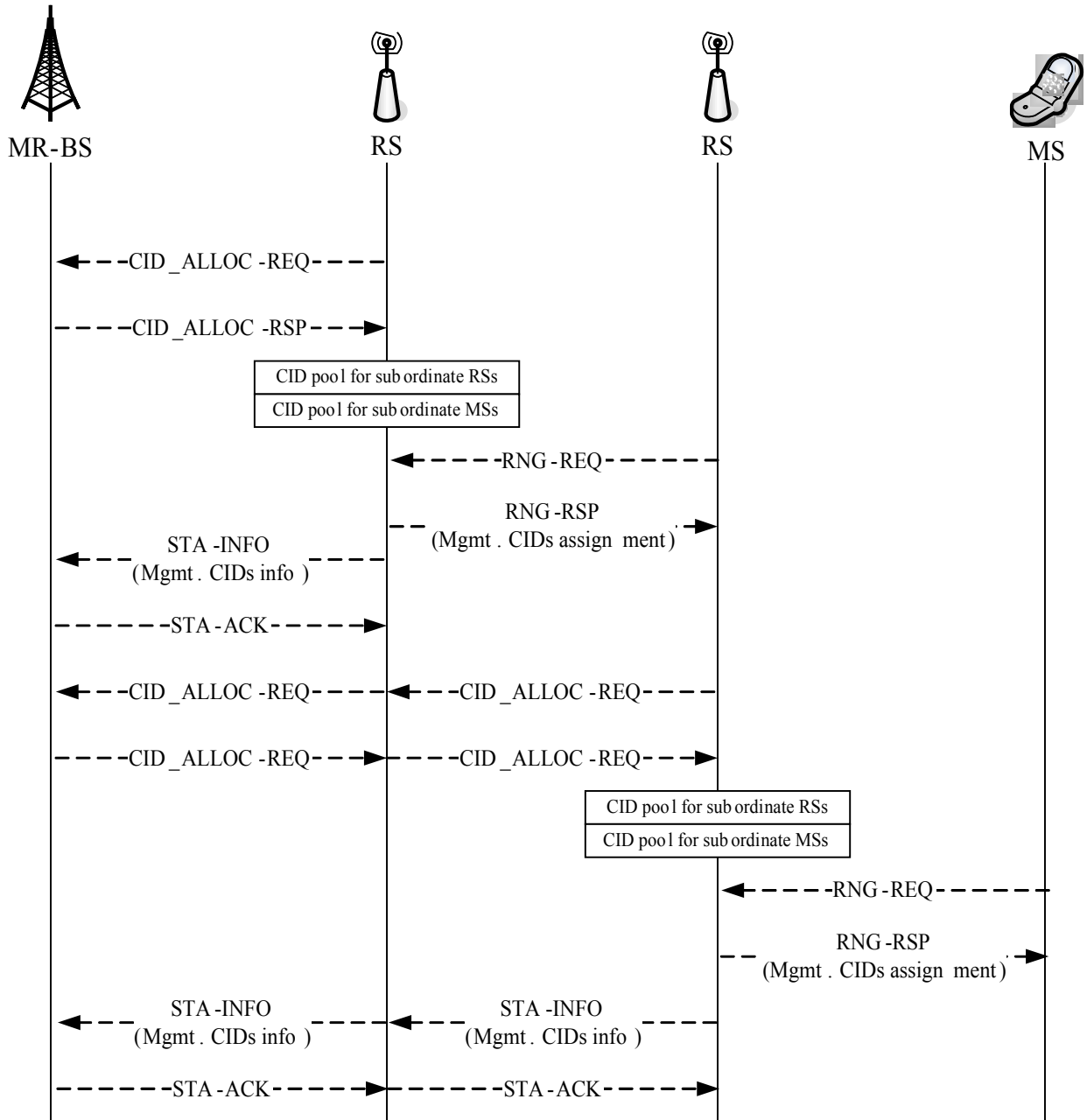
MR-BS can assign multiple management CIDs to RS during RS initial ranging process by using RNG-REQ/RSPCID-ALLOC-REQ/RSP messages. If management CID number is random, all the 16 bits CID numbers should be informed. It results in a long management message. To reduce the message length, consecutive CID 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  $2^{n \text{ hops number of MS}}$ , this method contributes to effective use of network resource.





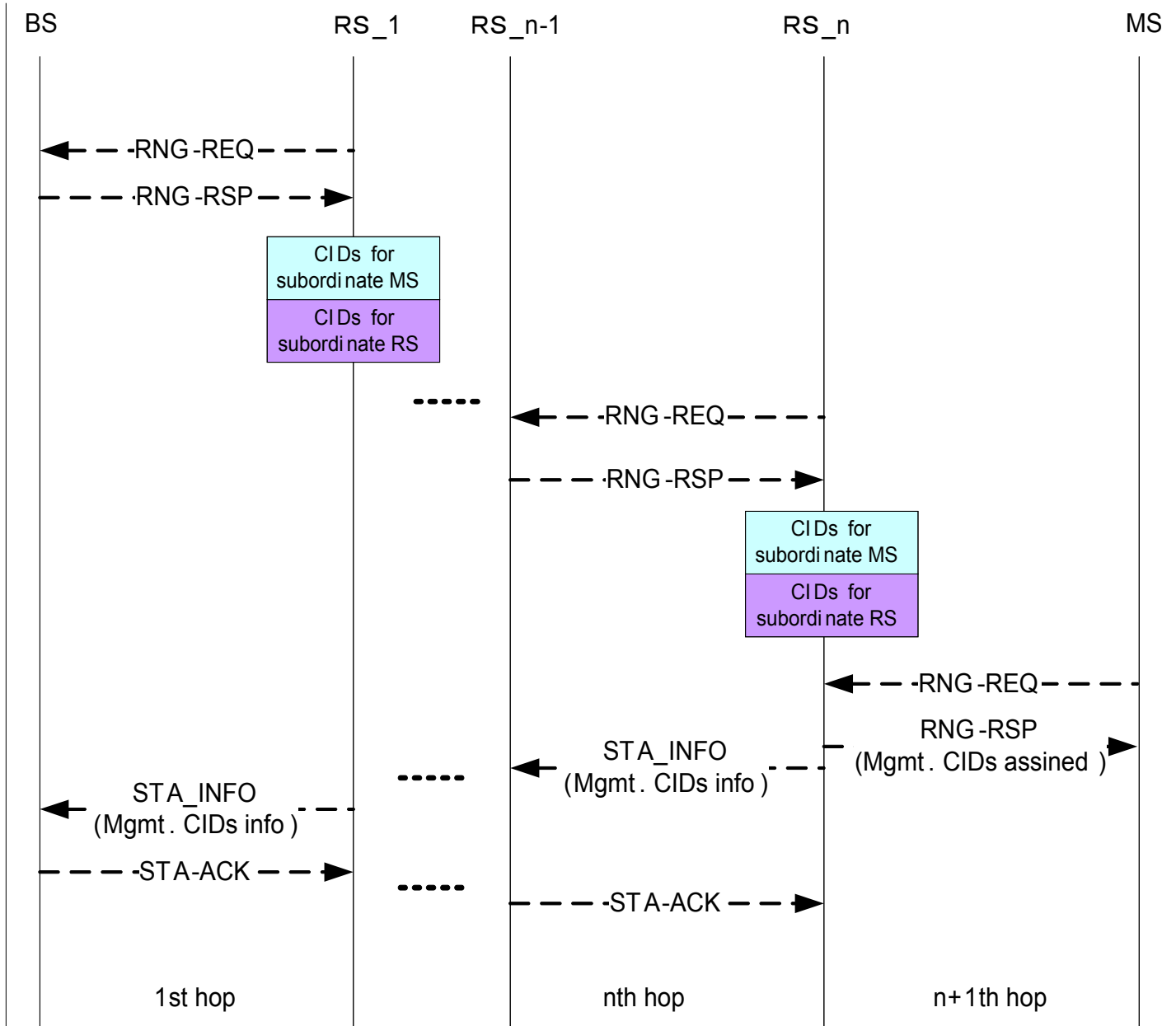


Figure 2 Management CIDs allocation and assignment

**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=bit partition method<br>12~7: 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. ~~XX67~~ 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. ~~XX68~~ 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        |   |
| <u>Message number</u>         | <u>4 bits</u> | <u>Message identification number in case of multiple messages</u> |
| 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 procedure allocation 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-INDLLC-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.

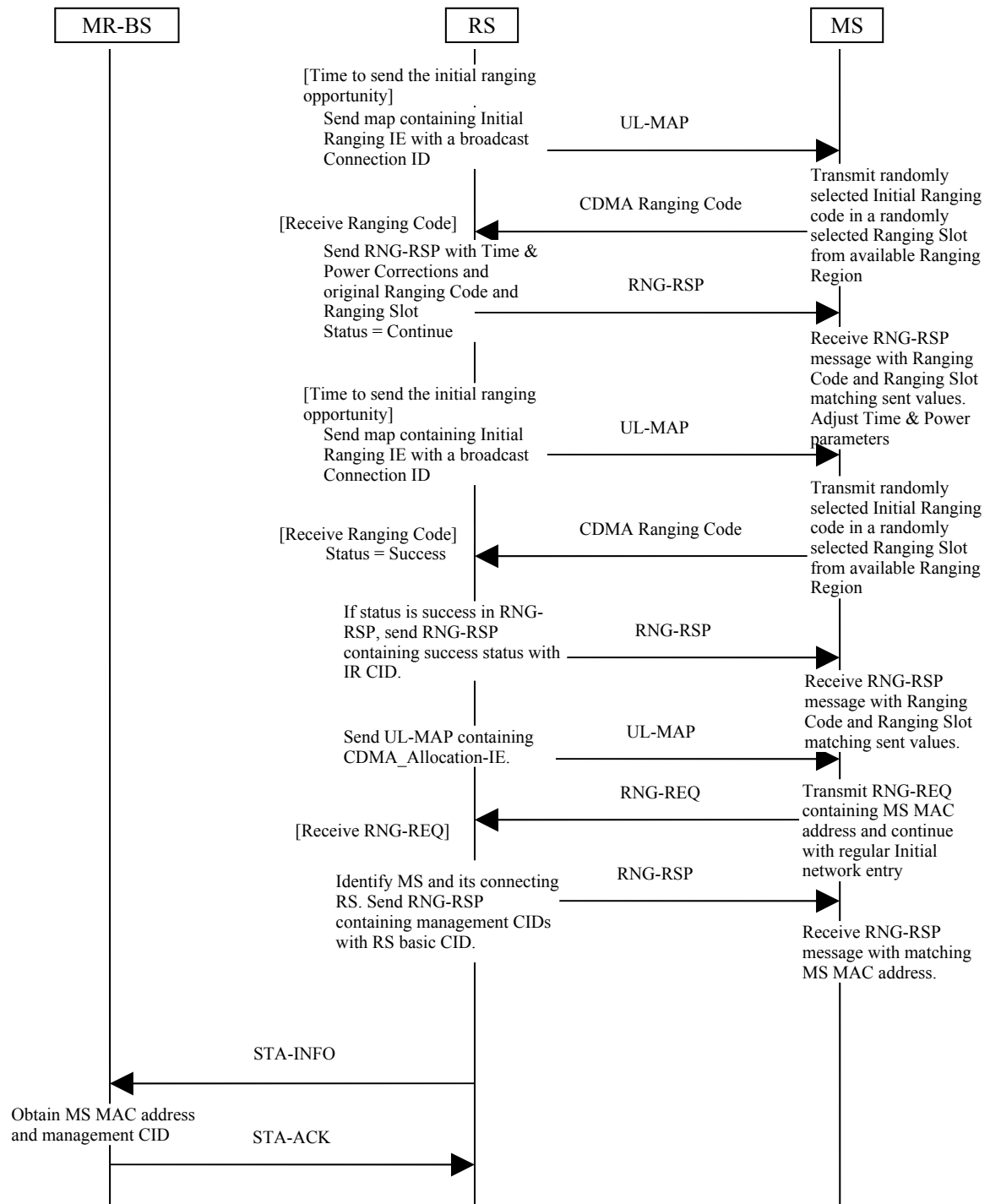


Figure xxx Ranging and automatic adjustments procedure with optional availability check at RS in MR-mode

### 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/loc-IND 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.

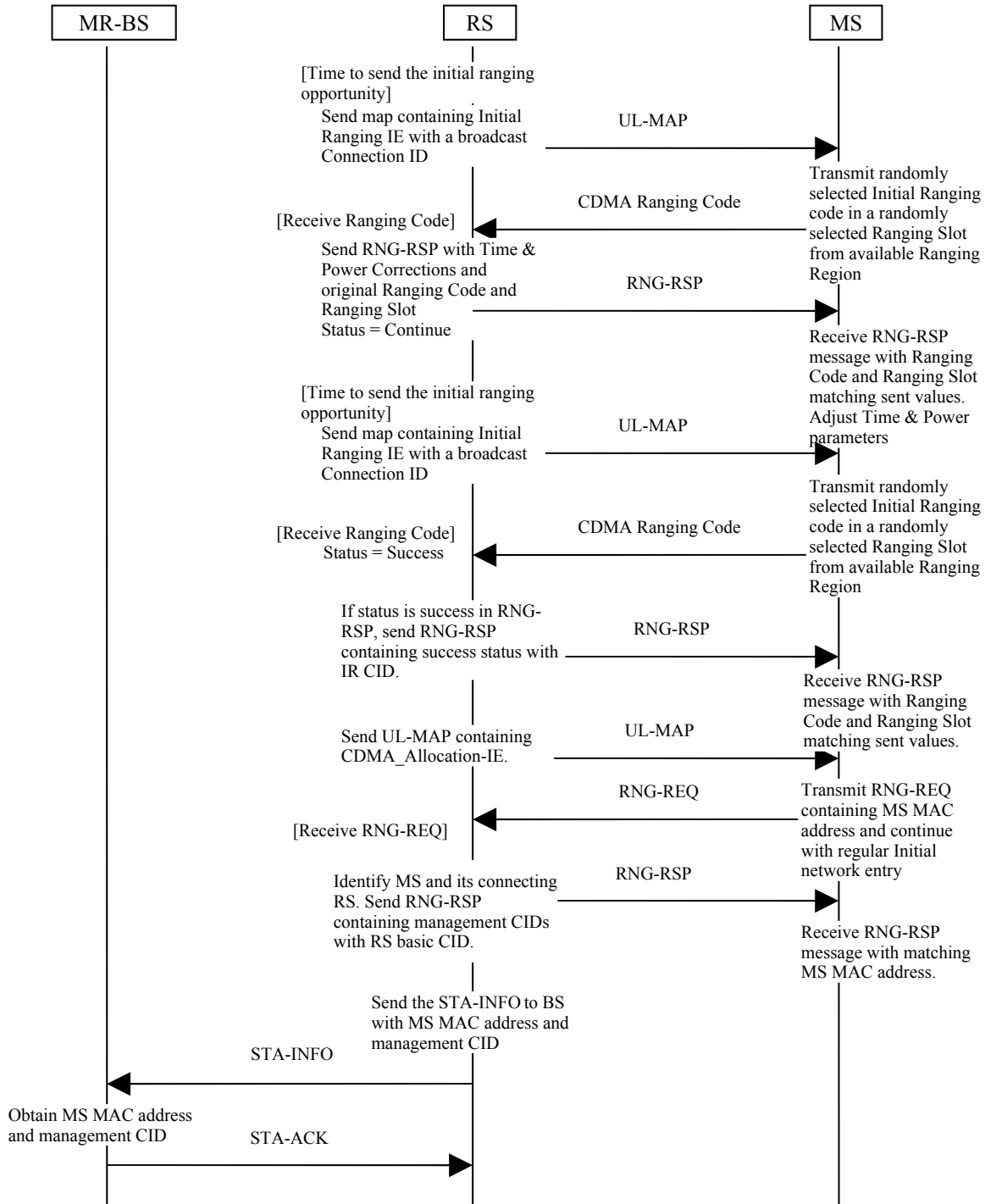


Figure xxx Ranging and automatic adjustments procedure with optional availability check at RS in MR mode



**11.5 ——— RNG-REQ message encodings**

Insert the following entries into Table 364:

Table 364 — RNG-REQ message encodings

| Name                                      | Type<br>(1 byte) | Length | Value<br>(variable-length)                      | PHY<br>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<br>(1 byte) | Length | Value<br>(variable-length)  | PHY<br>Scope |
|--------------------------------|------------------|--------|---|--------------|
| CID allocation method          | xx               | 1      | Used to indicate the CID allocation method of RSs<br>0: contiguous method                       | OFDMA        |
| Range of management CID for RS | xx               | 4      | If CID range allocation method==0:<br>Byte#0-1: start number of CID<br>Byte#2-3: number of CIDs | OFDMA        |
| Range of management CID for MS | xx               | 4      | Byte#0-1: start number of CID<br>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-07/241r5, “Systematic CID Allocation Connection Management and Relay Path Configuration”