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Re:	This contribution is response to call for technical proposal (IEEE 802.16j-07/007).	
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 (MMR) network.

Background

Figure 1 shows reference model of IEEE802.16j.

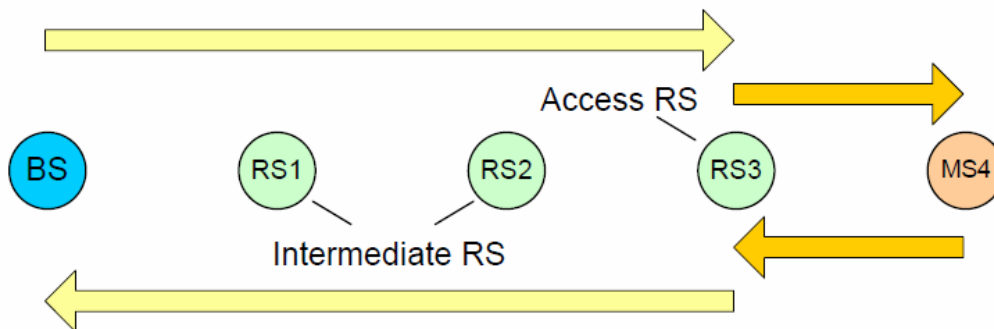


Figure 1 Reference Model of Network Entry for IEEE802.16j

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 BS and MS via RSs especially in network entry process. One method to reduce the round-trip time of the message transmission between BS and MS is pre-assignment of management CIDs to an access RS. By using the CID pre-assignment, some message exchanges can be done between the access RS and MS without going back to BS.

Proposed method

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

BS can assign multiple management CIDs to RS during RS initial ranging process by using RNG-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. 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 CID range to its subordinate node (MS or RS) on behalf of superordinate node (BS or RS) during ranging process or at any time whenever needed. In this process, although the management CIDs are assigned by RS, the 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 $2 \times (n \text{ hops} + \text{number of MS})$, this method contributes to effective use of network resource.

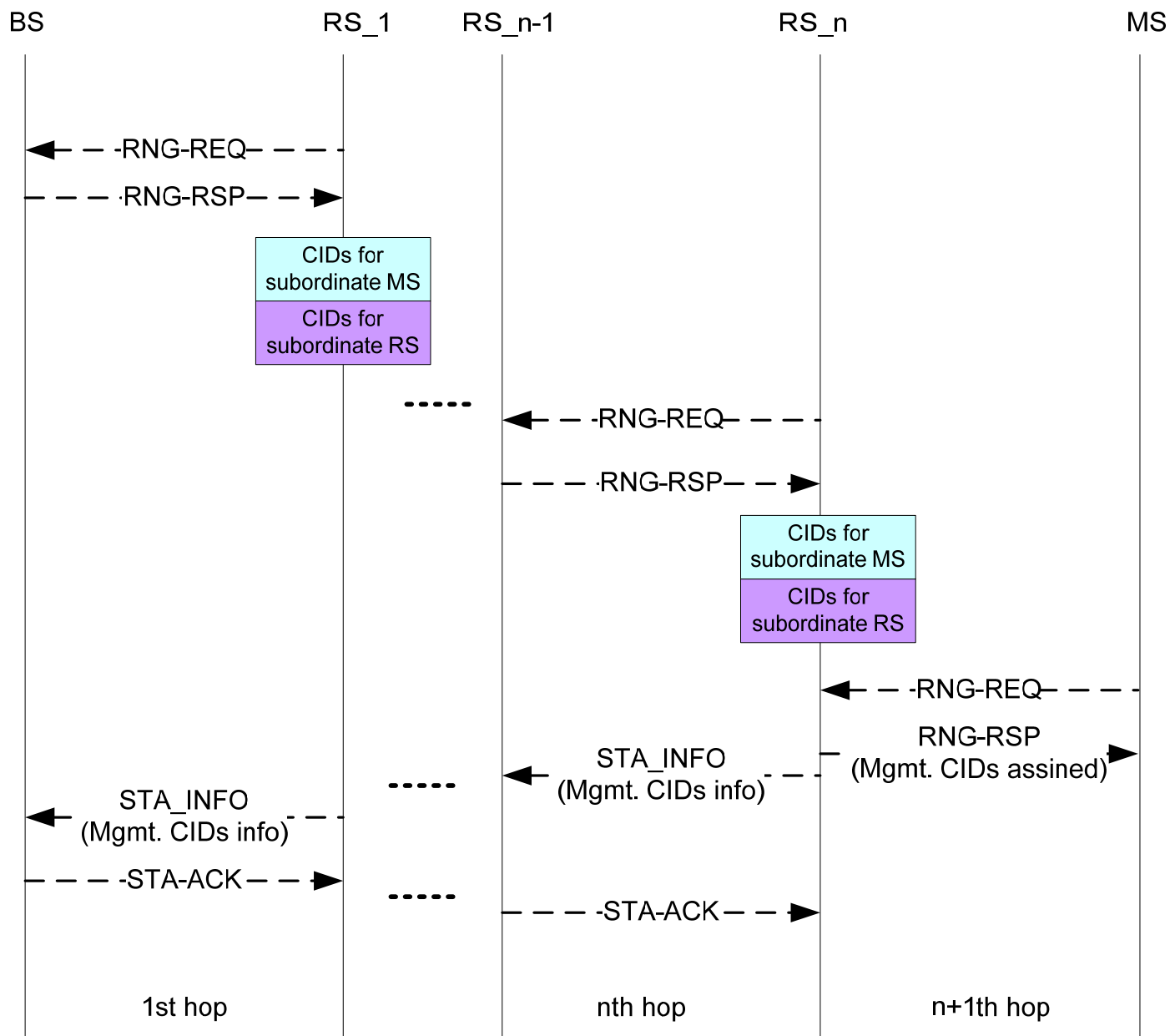


Figure 2 Management CIDs allocation and assignment

Text to be inserted into standard

6.3.2.3.5 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

6.3.2.3.XX 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 MS. 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
}		

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 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 0=De-allocation
CID_Alloc_method	3 bits	0 : contiguous method 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 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 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	
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**

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 a part of management CID range systematically or non-systematically to its subordinate RS during ranging process or 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.

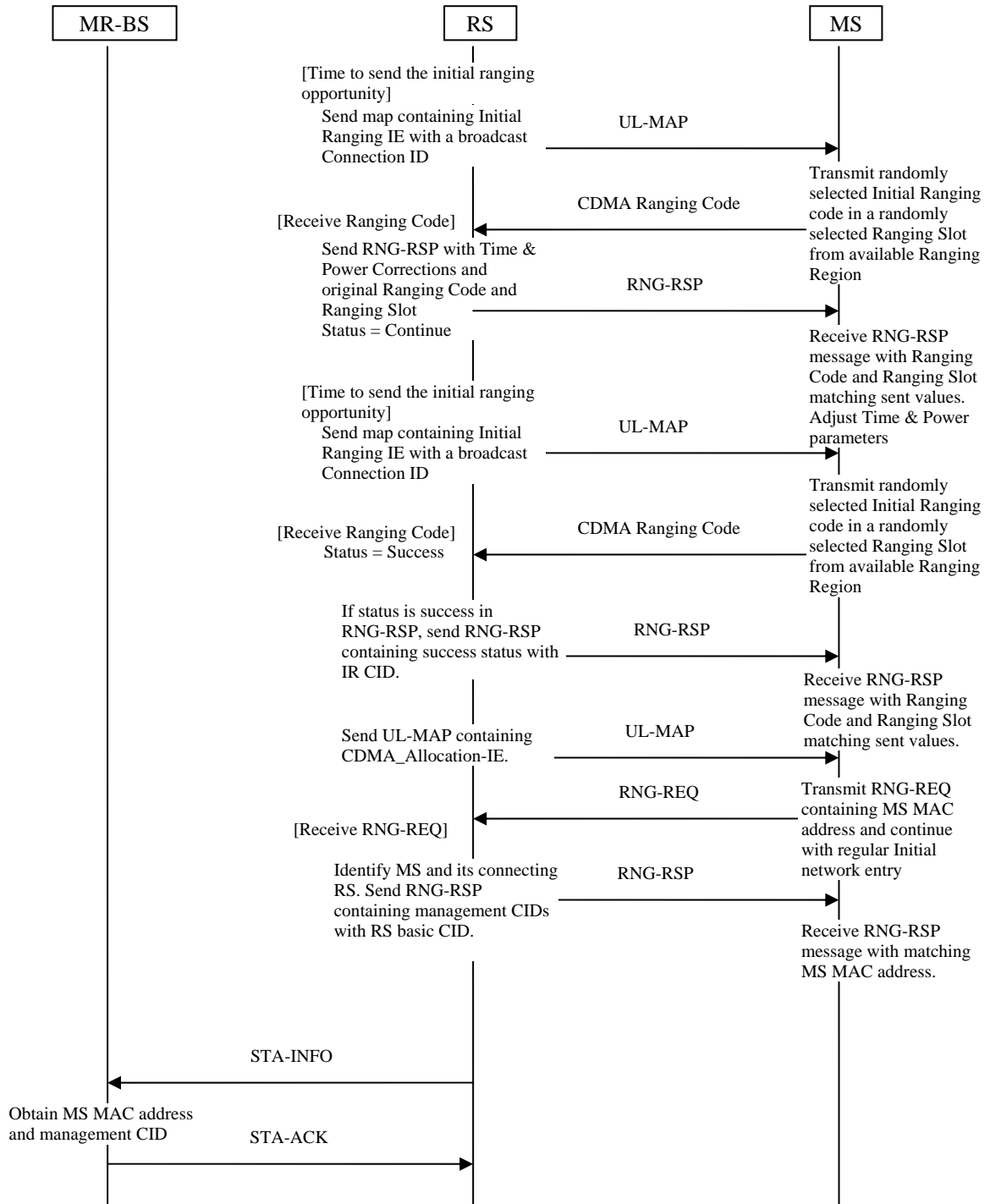


Figure xxx Ranging and automatic adjustments procedure with optional availability check at RS in MR mode

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 assign the management CIDs to its subordinate nodes (MS or RS) 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 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.

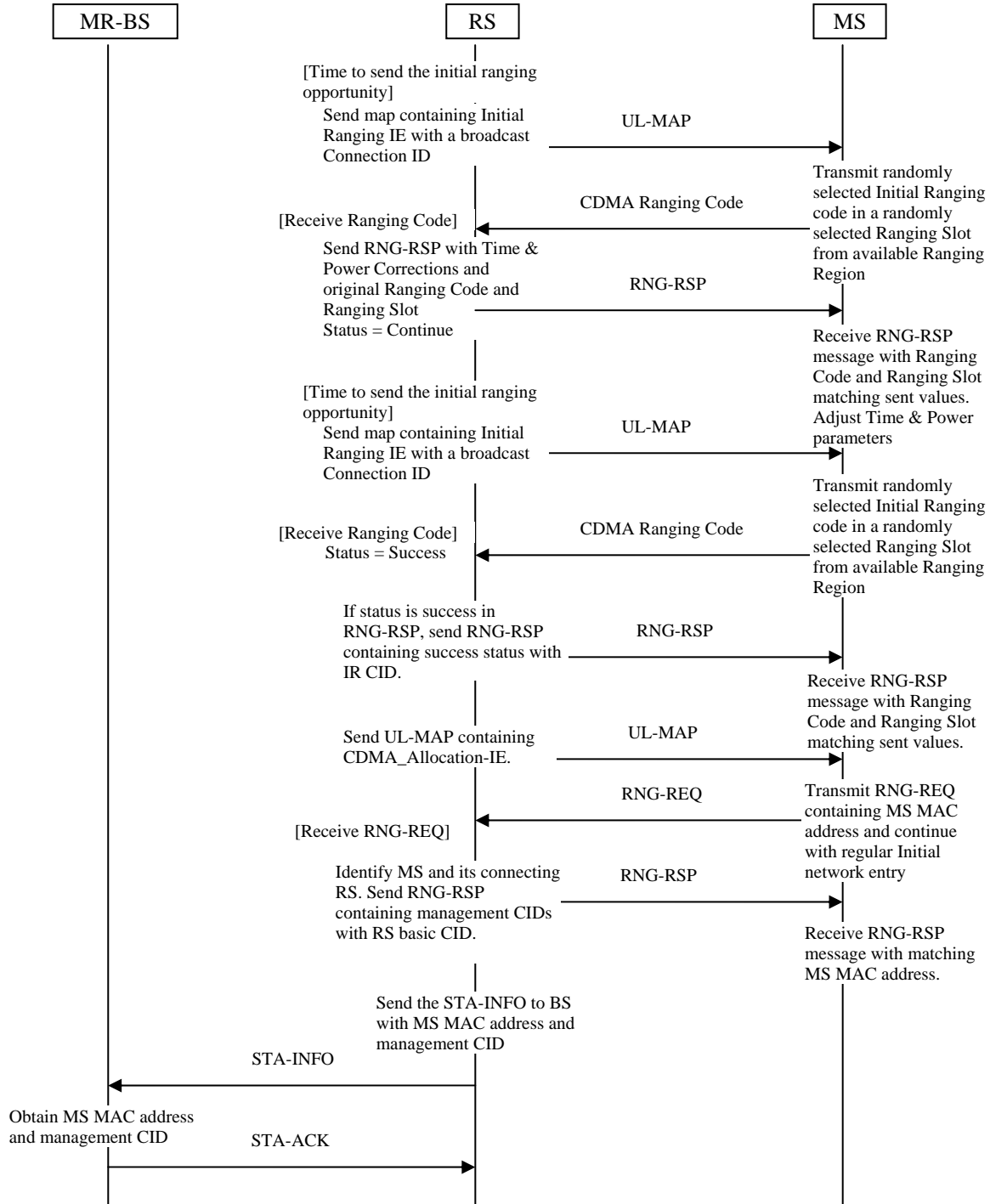


Figure xxx Ranging and automatic adjustments procedure with optional availability check at RS in MR mode

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”