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Title	**Comments on MS ranging and network entry in transparent and non-transparent mode**
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Re:	IEEE 802.16j-07/043: "IEEE 802.16 Working Group Working Group Letter Ballot #28"
Abstract	This contribution proposes to correct and merge the paragraphs in MS ranging and network entry in both transparent and non-transparent mode.
Purpose	Text proposal for 802.16j Draft Document.
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Comments on MS ranging and network entry in transparent and non-transparent mode

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Introduction

This contribution covers the following comments:

Comment#	subclauses	Authors		Type
177	6.3.9.16.2.1	Kanchei	Loa	Technical
556	6.3.9	Mike	Hart	Technical
559	6.3.9.16.1	David	Steer	Editorial
562	6.3.9.16	David	Steer	Editorial
563	6.3.9.16.4	Kanchei	Loa	Editorial
564	6.3.9.16.1	Peiying	Zhu	Technical
565	6.3.9.16.1	Kanchei	Loa	Technical
566	6.3.9.16.1	Kerstin	Johnsson	Technical
567	6.3.9.16.1, 6.3.9.16.2.1	Kanchei	Loa	Technical
568	6.3.9.16.1	David	Steer	Technical
569	6.3.9.16.1	David	Steer	Technical
570	6.3.9.16.1	Kanchei	Loa	Technical
571	6.3.9.16.1	Kanchei	Loa	Editorial
572	6.3.9.16.2.1	Kanchei	Loa	Editorial
573	6.3.9.16.1	Kerstin	Johnsson	Technical
574	6.3.9.16.1	Kanchei	Loa	Technical
575	6.3.9.16.1	Kanchei	Loa	Editorial
576	6.3.9.16.1, 6.3.9.16.2.1, 6.3.9.16.2.2	Kanchei	Loa	Editorial
577	6.3.9.16.1	Kanchei	Loa	Technical
578	6.3.9.16.1	Shyamal	Ramachandran	Technical
579	6.3.9.16.1, 6.3.10.3.4.1, 6.3.10.3.4.3	Kanchei	Loa	Editorial
580	6.3.9.16.1	Shyamal	Ramachandran	Editorial
581	6.3.9.16.1	Hongyun	Qu	Technical
582	6.3.9.16.1	Shyamal	Ramachandran	Technical
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584	6.3.9.16.1	Shyamal	Ramachandran	Technical
585	6.3.9.16.2	Mike	Hart	Editorial
586	6.3.9.16.2.1	Kanchei	Loa	Technical
587	6.3.9.16.2.1	Roger	Marks	Technical
588	6.3.9.16.2.1	Kerstin	Johnsson	Technical
589	6.3.9.16.2.1	Shyamal	Ramachandran	Editorial
590	6.3.9.16.2.1	Kanchei	Loa	Editorial
591	6.3.9.16.2.1	Shyamal	Ramachandran	Technical
592	6.3.9.16.2.1	Yousuf	Saifullah	Technical
593	6.3.9.16.2.1	Adrian	Boariu	Editorial
594	6.3.9.16.2.1	Mike	Hart	Technical
595	6.3.9.16.2.1	Hyunjeong	Kang	Technical
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597	6.3.9.16.2.1	Kerstin	Johnsson	Technical
598	6.3.9.16.2.1	Gamini	Senarath	Technical
599	6.3.9.16.2.1	Shyamal	Ramachandran	Technical
600	6.3.9.16.2.1, 6.3.10.3.4.2.1, 6.3.10.3.4.4.1	Kanchei	Loa	Editorial

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602	6.3.9.16.2.1.1	Kerstin	Johnsson	Editorial
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604	6.3.9.16.2.2	Kerstin	Johnsson	Technical
605	6.3.9.16.2.2, 6.3.10.3.4.2.2, 6.3.10.3.4.4.2	Kanchei	Loa	Technical
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608	6.3.9.16.2.2	Sean	McBeath	Editorial
609	6.3.9.16.2.2	David	Steer	Editorial
610	6.3.9.16.2.2	Shyamal	Ramachandran	Editorial
611	6.3.9.16.2.2	David	Steer	Technical
612	6.3.9.16.2.2	Kerstin	Johnsson	Technical
613	6.3.9.16.2.2	Kerstin	Johnsson	Technical
614	6.3.9.16.2.2	David	Steer	General
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618	6.3.9.16.3	Ronald	Mao	Technical
652	6.3.9.16.3.3	Gamini	Senarath	Technical
653	6.3.9.16.3.4	Mike	Hart	Technical
657	6.3.9.16.3.4	Hyunjeong	Kang	Technical
664	6.3.9.16.4	Erik	Colban	Technical
665	6.3.9.16.4	Mike	Hart	Technical
666	6.3.9.16.4.2	Junichi	Suga	Technical
667	6.3.9.16.4.2	Guo Qiang	Wang	Technical
668	6.3.10.3.4.1	Hongyun	Qu	Technical
669	6.3.10.3.4.1	Gamini	Senarath	Technical
670	6.3.10.3.4.4	Mike	Hart	Technical
671	6.3.10.3.4.1	Kerstin	Johnsson	Technical
672	6.3.10.3.4.2	Kerstin	Johnsson	Technical
673	6.3.10.3.4.2.1	Gamini	Senarath	Technical
674	6.3.10.3.4.2.1	Yousuf	Saifullah	Technical
675	6.3.10.3.4.2	yanling	Lu	Technical
676	6.3.10.3.4.3	Kerstin	Johnsson	Technical
677	6.3.10.3.4.3, 6.3.10.3.4.4.1, 6.3.10.3.4.4.2	Kanchei	Loa	Editorial
678	6.3.10.3.4.3	Junichi	Suga	Editorial
679	6.3.10.3.4.3	Junichi	Suga	Editorial
680	6.3.10.3.4.4.1	Kerstin	Johnsson	Technical
681	6.3.10.3.4.4.1	Yousuf	Saifullah	Technical
682	6.3.10.3.4.4.1	Junichi	Suga	Editorial
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685	6.3.10.3.4.5	Yousuf	Saifullah	Technical
686	6.3.10.3.4.6	Kanchei	Loa	Editorial
971	6.3.9.16.4.2	Shulan	Feng	Technical
1047	6.3.9.16.4	Chion	Mary	Technical

In P802.16j/D1, the MS ranging behaviors, which have been defined in 802.16e, are redundantly described in subclauses for MS CDMA initial, periodic and bandwidth-request ranging in both transparent and non-transparent mode. These redundant texts are inconsistent with original text of 802.16e and are potentially troublesome for future maintenance of the standard. Hence, we propose to merge 6.3.9.16.1 and 6.3.9.16.2 into 6.3.10.3.1 "*Contention-based initial ranging and automatic adjustments*", 6.3.10.3.4.1 ~ 6.3.10.3.4.4 into 6.3.10.3.2 "*Periodic ranging and automatic adjustments*", and 6.3.10.3.4.5 into 6.3.10.3.3 "*CDMA HO ranging and automatic adjustment*", respectively, which are consistent with how the MS CDMA ranging and OFDMA-based network entry procedure have been described in IEEE 802.16e-2005 (P802.16REV2-D0d).

Other technical issues that we proposed to resolve in this contribution are following.

1. In the draft document, MR_Code-REP message is used for reporting received CDMA BR ranging code, whereas RNG-REQ message is used for reporting received CDMA initial, handover and periodic ranging codes. By comparing the response latency and message size, using MR_Code-REP message is a better scheme, which also handles reporting multiple CDMA code more efficiently. That is, initial, periodic, BR and handover ranging codes receiving in a frame could be carried by one MR_Code-REP message as multiple codes. Therefore, we propose to replace RNG-REQ message with MR_Code-REP message for all CDMA ranging. After unifying CDMA ranging code report with the MR_Code-REP message, paragraphs and diagrams (sequences charts and flow charts) to handle MS CDMA initial, periodic and bandwidth-request ranging in transparent mode could be combined into one unified scheme.

   The response latency and message size of using RNG-REQ and MR_Code-REP are described in Figure 1 and Table 1, respectively. In the left side of Figure 1, the value of T48 must be at least 5 frames (25 ms for 5-ms frame). The MR-BS should allocate at least 41 bytes for RS sending RNG-REQ message and will send RNG-RSP (or CDMA allocation IE) at the 6th frame after MS sends initial ranging code. Thus, the minimum latency of initial or periodic ranging is 30 ms for 5-ms frame. In the right side of Figure 1, the value of T48 must be at least 3 frames (15 ms for 5-ms frame). MR-BS should allocate at least 26 bytes for RS sending MR-Code-REP message and will send RNG-RSP (or CDMA allocation IE) at the 4th frame after MS sends initial ranging code. Thus, the minimum latency of initial or periodic ranging is 20 ms for 5-ms frame. In summary, response latency and message size for using MR_Code-REP are less than those for using RNG-REQ.

Table 1 Message sizes for RNG-REQ and MR_Code-REP message

Size \ Message		RNG-REQ (bytes)	MR-Code-REP (bytes)
Generic MAC header		6	6
Message body	Fix part	2	2
	Variable part	$14\times Nr$ ~ $29\times Nr$	$14\times Nr$
CRC		4	4
Total		$12+14\times Nr$ ~ $12+29\times Nr$	$12+14\times Nr$

Nr: *Number of CDMA ranging code in a RNG-REQ or an MR_Code-REP message*

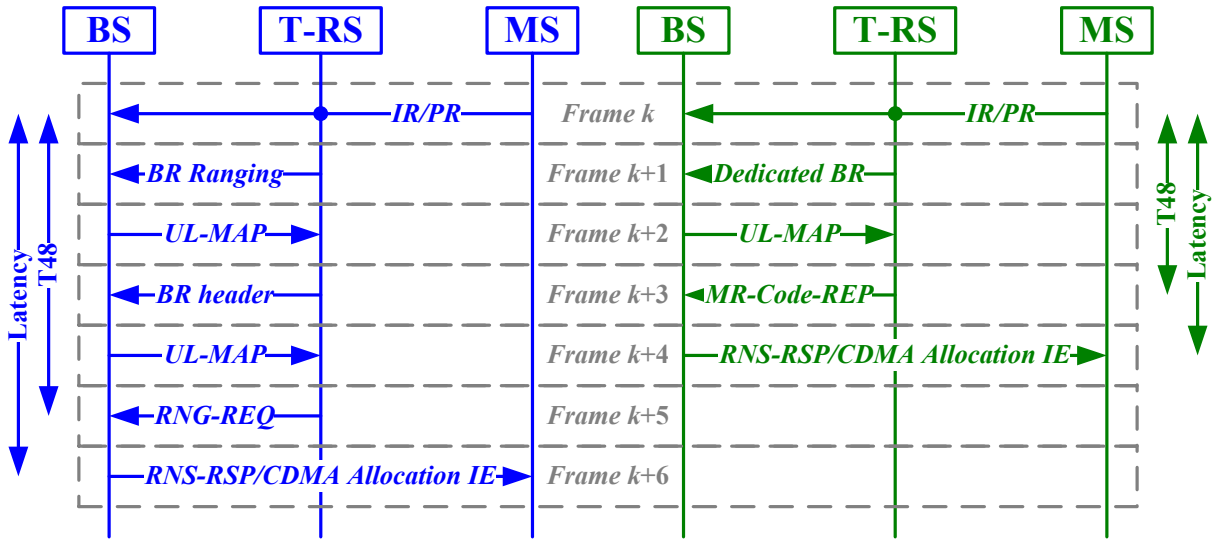


Figure 1 Response latencies for using RNG-REQ and MR_Code-REP

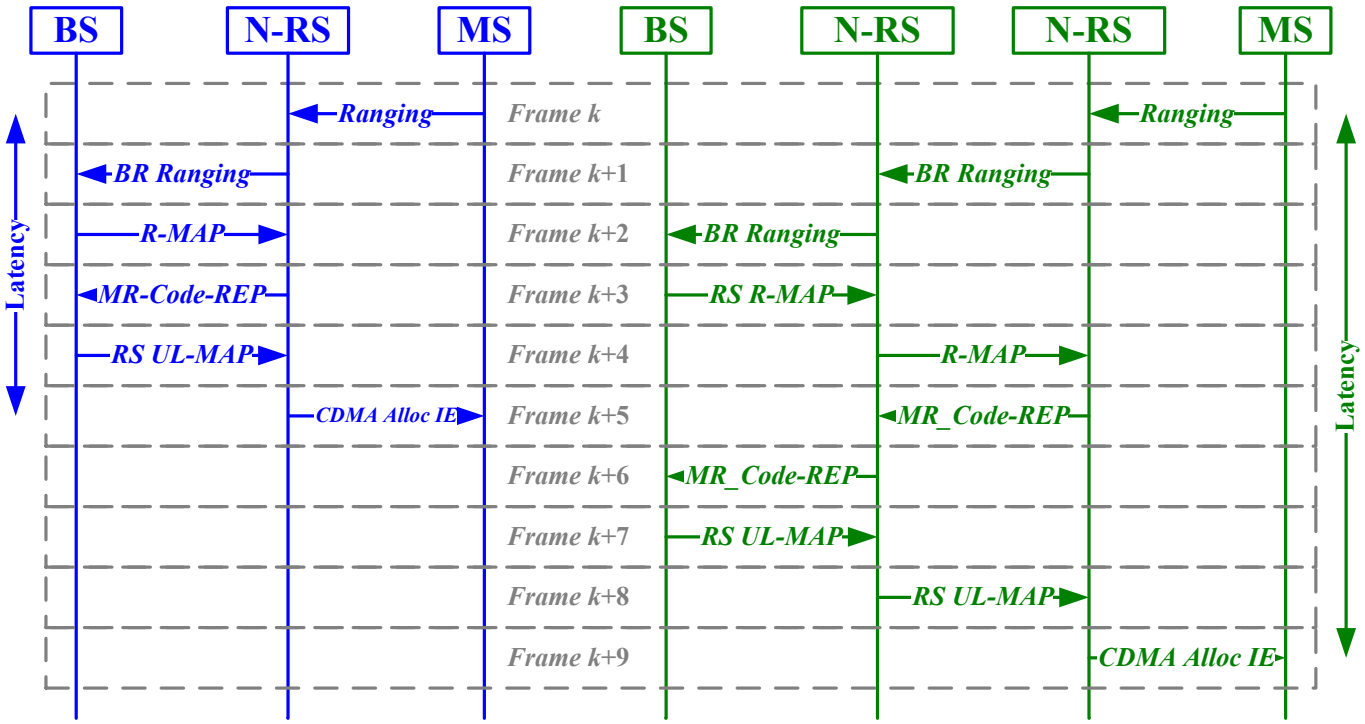
2. In the draft standard, the MR_Code-REP header is used to request MR-BS to allocate BW via CDMA-Allocation_IE for MS sending BR header after RS receiving CDMA BR ranging code, whereas RNG-REQ message is used to request MR-BS to allocate BW via CDMA-Allocation_IE for MS sending RNG-REQ message after RS receiving CDMA initial and handover ranging codes. However, because of the limitation of T3 timer (60 ms for initial or periodic ranging), the current scheme that utilizes RNG-REQ message cannot be used to request CDMA-Allocation_IE for non-transparent RS with hop-count more than two. Therefore, the latency of MS requesting CDMA-Allocation_IE needs to be reduced. In addition, by comparing the response latency and message/header size, using MR_Code-REP header is a better scheme, which also handles reporting multiple CDMA code more efficiently. Hence, we propose to use "MR_Code-REP header" instead of "RNG-REQ message" for requesting CDMA-Allocation_IE for MS.

   The message size and response latency of using MR_Code-REP header and RNG-REQ message are described in Table 2 and Figure 2, respectively. The minimum latencies of 2-hop and 3-hop scenarios using RNG-REQ message are 7 and 13 frames (35 ms and 65 ms for 5-ms frame), respectively. Hence the latency using RNG-REQ message in 3-hop scenario becomes unacceptable since the T3 timer (60 ms for initial or periodic ranging) at MS side has already been expired. The minimum latencies of 2-hop and 3-hop scenarios using MR_Code-REP header are 5 and 9 frames (25 ms and 35 ms for 5-ms frame), respectively. In summary, the response latency and message size for using MR_Code-REP header are less than response latency and message size for using RNG-REQ message. The comparison of response latency of using MR_Code-REP header and RNG-REQ message are described in Table 3.

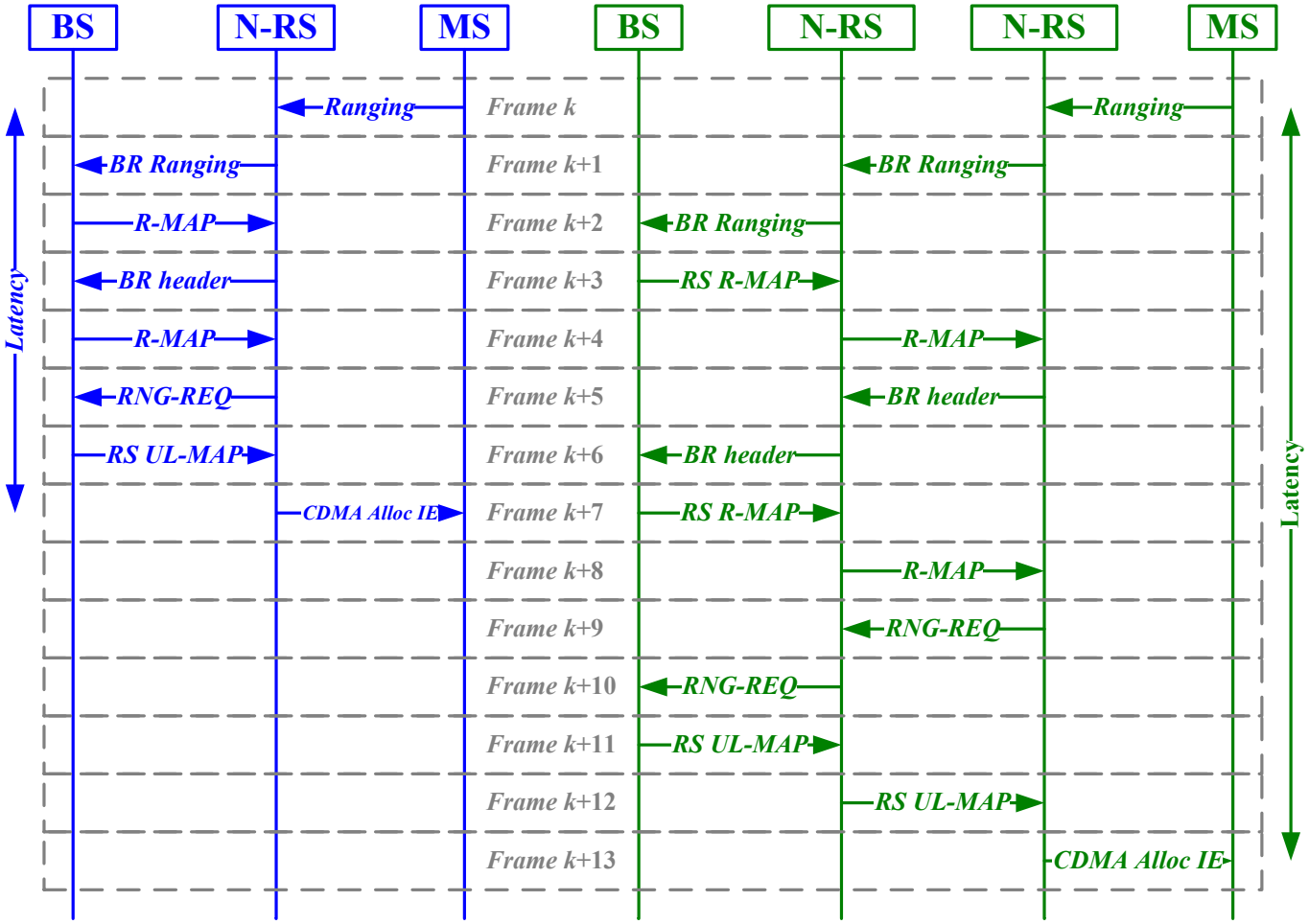
Table 2 Message sizes for RNG-REQ message and MR_Code-REP header

Size \ Message		RNG-REQ (bytes)	MR-Code-REP (bytes)
Generic MAC header		6	6
Message body	Fix part	2	0
	Variable part	14×*Nr*	0
CRC		4	0
Total		12+14×*Nr*	6

Nr: *Number of CDMA ranging code in a RNG-REQ message or an MR_Code-REP header*



(a) Response latency for using MR_Code-REP header



(b) Response latency for using RNG-REQ message

Figure 2 Response latencies of 2-hop and 3-hop scenarios

Table 3 Minimum latency for multi-hop systems

Hop count	*Latency (5-ms frame)*			
	RNG-REQ		*MR-Code-REP*	
	frame	*ms*	*frame*	*ms*
2	**7**	**35**	**5**	**25**
3	13	65	**9**	**45**
4	19	95	13	65

3. The MR-BS in the transparent mode may receive the MS ranging code directly or indirectly through the RS. If the MS ranging is received by the MR-BS and RS, the T48 timer is triggered immediately as soon as received by MR-BS. If the MS ranging could only be received by the RS, the T48 timer is triggered after MR-BS receiving the relaying message with the MS ranging code from the RS. Therefore, the actual waiting time for the MR-BS is the T48 plus the latency of relayed MS ranging code. In order to resolve this issue, the value of T48 timer under the indirect scenario, where only the RS receives the MS ranging code, must be adjusted by the latency of relaying MS ranging code, such that the actual waiting is equal to the value of T48 for the direct scenario, where the MR-BS receives the MS ranging code directly.

   For example, in an indirect scenario described in the right one of figure 3 with T48 set to 5 frame (25 ms for 5-ms frame), MR-BS receives the relaying MS ranging code from RS at 5th frame after MS sends initial ranging code, and then sends RNG-RSP (or CDMA allocation IE) at 11th frame. Thus, the minimum latency of initial or periodic ranging is 55ms. If we consider the implementation safety margin, the value of T48 is at least 6 frames (30 ms). Thus, the latency will be at least 13 frames (65 ms), which is larger than the value of T3 timer (60 ms for initial or periodic ranging). Hence, the latency becomes unacceptable since the T3 timer at MS side has already been expired. Hence, the adjusted value of T48 for the indirect scenario should be 30 ms (original T48) minus 25 ms (latency of relaying MS ranging code).

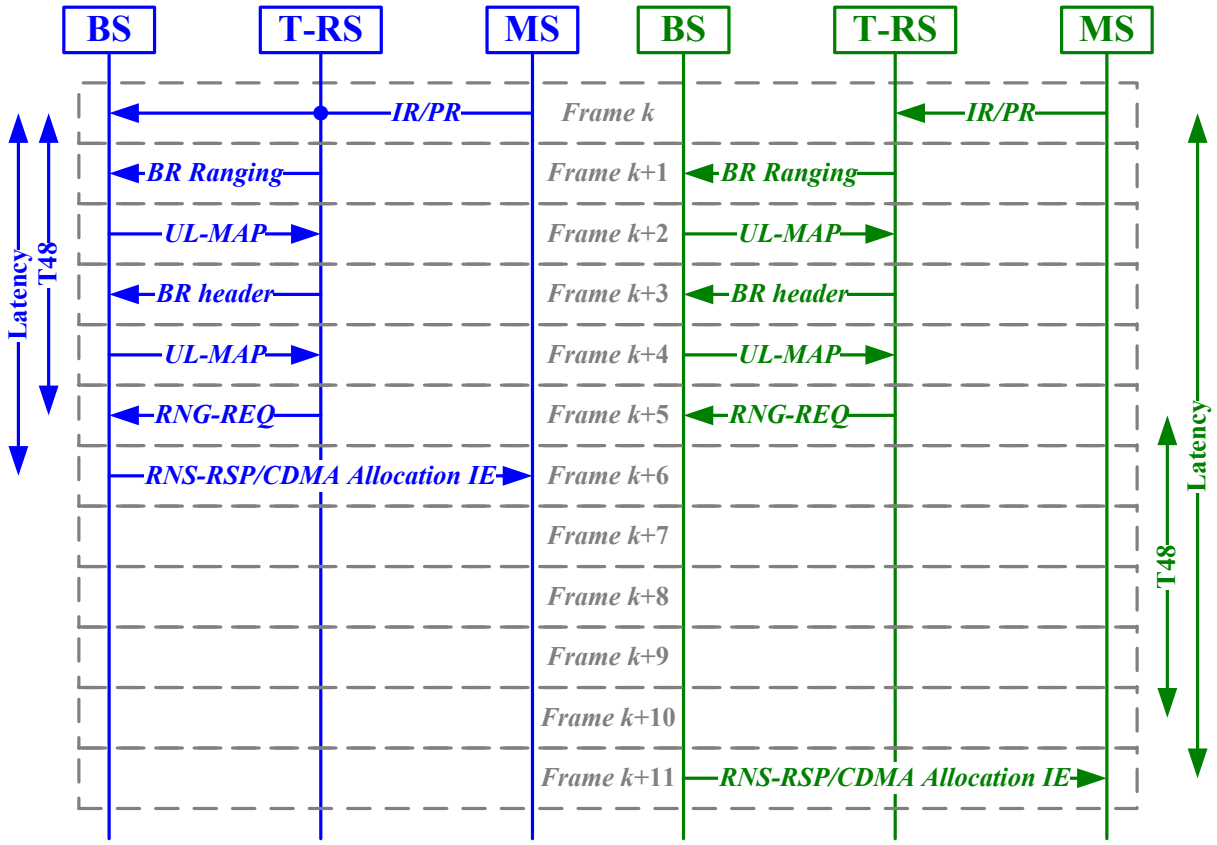


Figure 3 Response latency and T48 timer for using RNG-REQ message

4. In the draft document (line 37 of page 89), it says that "When the MR-BS receives initial ranging code or RNG-REQ containing initial ranging code with RS basic CID at the first time, it shall wait for RNG-REQ with the same ranging code from its subordinate RSs for T48 timer. Once T48 timer expired, the MR-BS compares measured signal information at each station to decide the most appropriate path to communicate with the code originating MS, according to channel measurement information." Since the MR-BS is the only one who decides the ranging “Status” after comparing measured signal information from each access station, we propose to remove “Status = Continue” and “Status = Success” associated with the RS in diagrams such that diagrams are consistent with the text.

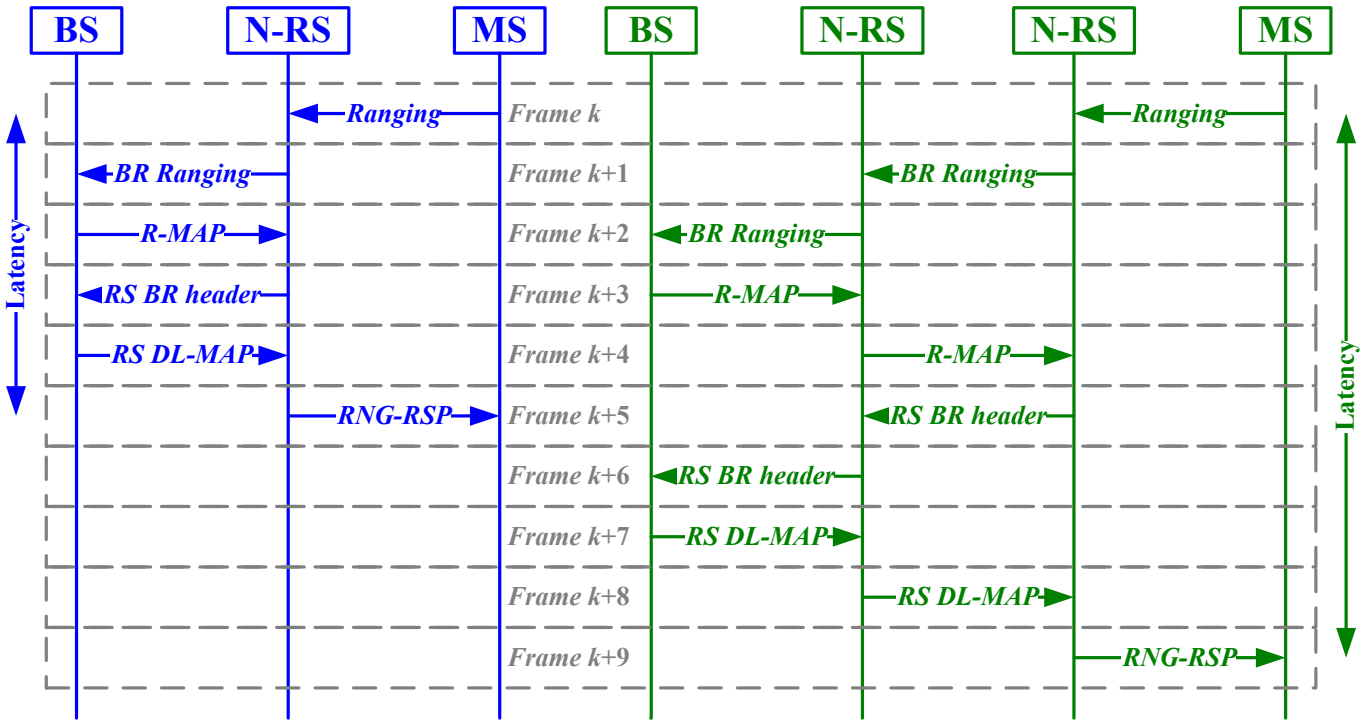
5. In the draft standard, the non-transparent RS under centralizing scheduling shall locally broadcast RNG-RSP message(s) on the access link. In order to broadcast RNG-RSP message, first RS must send CDMA BR ranging to request 6-byte uplink bandwidth allocation for sending RS BR header; then the RS must send RS BR header to MR-BS to request downlink bandwidth for the RNG-RSP message). Because of the limitation of T3 timer (60 ms for initial or periodic ranging), the current scheme cannot be used to request BW for the RS with hop-count more than three, therefore, the latency needs to be reduced. In order to shorten latency during the ranging procedure, we suggest that either the MR-BS should pre-schedule proper UL bandwidth in relay link for sending RS BR header to the MR-BS after allocating Ranging channel in the RS access link or the RS should use dedicated ranging code to request BW on its access downlink (for SS) for sending a RNG-RSP message. The advantage of using RS BR header is to handle reporting multiple CDMA code more efficiently. That is, initial, periodic, BR ranging and handover ranging codes receiving in a frame could be handled by one RS BR header message as multiple codes.

   The response latencies for using anonymous ranging code for sending RS BR header (to request bandwidth to send RNG-RSP), using dedicated uplink bandwidth for sending RS BR header, and using dedicated ranging code for sending RNG-RSP are described in Figure 4. In Figure 4, the minimum latency of CDMA ranging response for 2-hop and 3-hop are 5 and 9 frames (25 and 45 ms for 5-ms frame). Furthermore, the minimum latency with hop-count more than four is lager than 13 frames (65 ms for 5-ms frame) and becomes unacceptable since the T3 timer (60 ms for initial or periodic ranging) at MS side has already been expired. The comparisons of response latency are described in Table 4. In order to resolve this issue, we recommend using Feedback Polling IE or dedicated ranging code to shorten the latency (see Figure 1b and 1c), where the minimum response latency for 2-hop and 3-hop scenario are 3 and 5 frames (i.e., 15 and 25 ms for 5-ms frame), respectively.

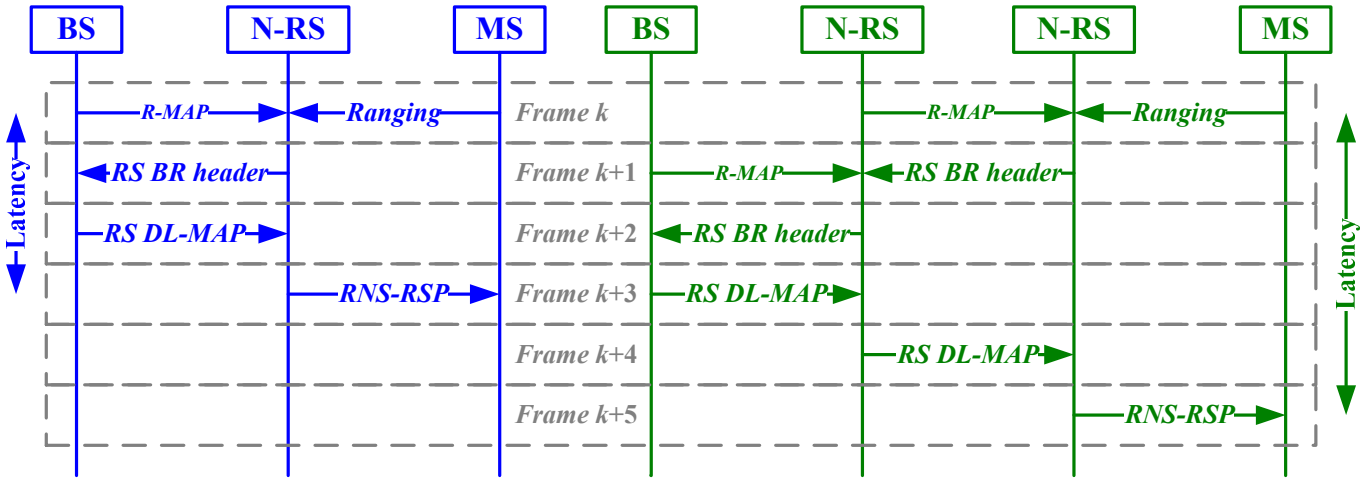
Table 4 Minimum latency for multi-hop systems

Hop count	*Latency (5-ms frame)*			
	(a)		*(b) and (c)*	
	frame	*ms*	*frame*	*ms*
2	**5**	**25**	**3**	**15**
3	**9**	**45**	**5**	**25**
4	13	65	**7**	**35**
5	17	85	**9**	**45**
6	21	105	**11**	**55**
7	25	125	13	65

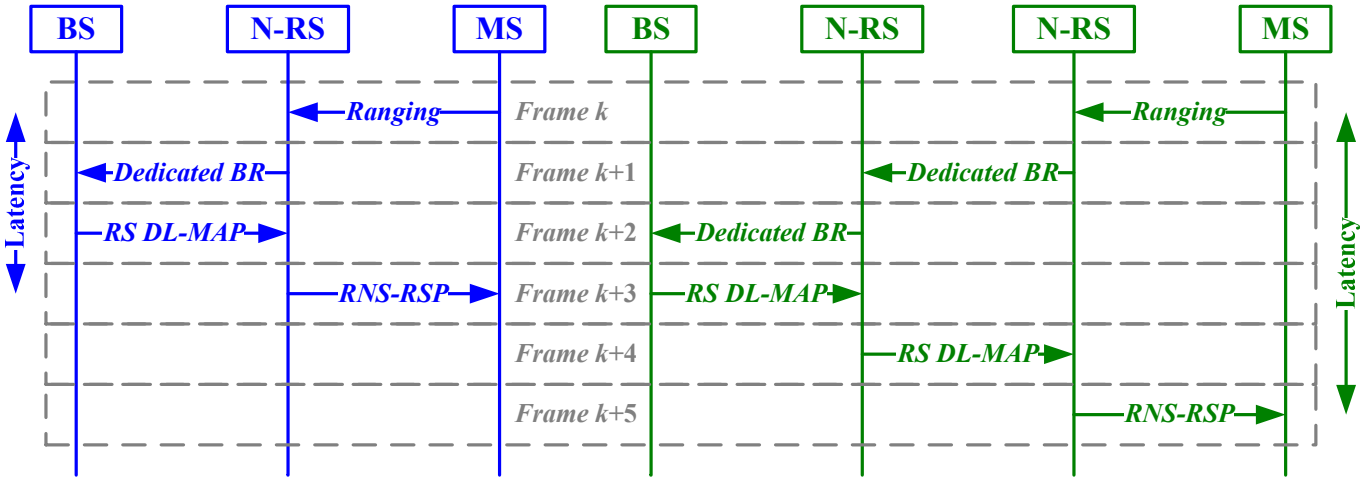
In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the draft standard P802.16j/D1 are listed below.



(a) Using anonymous ranging code for sending RS BR header to request bandwidth to send RNG-RSP



(b) Using dedicated uplink bandwidth for sending RS BR header to request bandwidth to send RNG-RSP



(c) Using dedicated ranging code for sending RNG-RSP

Figure 4 Latencies during the ranging procedure for 2-hop and 3-hop scenarios

Specification Changes

6.3.2.1.2.2.2.5 MR_Code-REP header

[Change the following table in line 24 of page 15 as indicated]

Table xxx Description of fields in MR_Code-REP header

Name	Length	Description
HT	1 bit	= 1
EC	1 bit	= 1
Type	1 bit	= 1
Extended Type	3 bits	= 5
Frame Number Index	4 bits	LSBs of relevant frame number
Number of Received IR CDMA Codes	4 bits	Number of CDMA initial ranging code that requires no correction
Number of Received HR CDMA Codes	4 bits	Number of CDMA handover ranging code that requires no correction
Number of Received BR CDMA Codes	6 bits	Number of CDMA bandwidth request ranging code
~~Reserved~~	~~12 bits~~	
Basic CID	16 bits	RS basic CID
HCS	8 bits	Header Check Sequence (same usage as HCS entry in Table 5).

[Replaced the following subclause as indicated:]

6.3.6.7.2.1 Bandwidth request handling and transmission in centralized mode

In centralized mode, RSs shall forward all bandwidth request headers and bandwidth request CDMA ranging code information they receive from subordinate stations to the MR-BS. The RS can not combine bandwidth request amounts from various sources since the MR-BS must know the details of each bandwidth request in order to assign uplink bandwidth along the proper route.

When a non-transparent RS receives one or more bandwidth request CDMA ranging codes in a frame from its subordinate SSs, it shall forward an MR_Code-REP header using its RS basic CID to the MR-BS. The MR_Code-REP header shall indicate the number of bandwidth request CDMA ranging codes the RS received. Upon receiving an MR_Code-REP header from a non-transparent RS, the MR-BS shall insert CDMA Allocation IEs with certain fields zeroed out into the UL-MAP that it assigns to that RS to broadcast on the access link. These CDMA_Allocation_IEs will have zeros in the fields for Frame Number Index, Ranging Code, Ranging Symbol, and Ranging Subchannel. When a non-transparent RS receives a message from the MR-BS with an assigned UL-MAP containing CDMA_Allocation_IEs with zeroed out fields, the RS shall fill in these fields with the appropriate ranging code and transmit region information and then broadcast this updated UL-MAP on the access link.

From time to time, an RS may also need to request ~~uplink~~ bandwidth for its own management messages~~ or for queued data whose previous transmissions have failed~~.

Bandwidth requests from the RS for its relay uplink may be stand-alone bandwidth request headers or piggybacked on other MAC PDUs. All requests shall be made in terms of the number of bytes needed to carry the MAC header and payload (not including the PHY overhead). The bandwidth request header may be transmitted during any relay uplink allocation, except during initial ranging.

If the RS has available uplink bandwidth, it shall simply forward the bandwidth request information to its superordinate station. Otherwise, the RS ~~will have to~~ shall request uplink bandwidth from the MR-BS using standard or special RS CDMA ranging codes (see 6.3.6.7.2.1.1).

If the RS needs bandwidth for a management message on its access/relay downlink to a subordinate MS/RS, the RS shall either send an RS CDMA ranging code dedicated for that purpose or an RS BR header. In response,

the MR-BS shall allocate resources in the RS DL-MAP for the transmission of a management message and notify the RS of this resource by inserting the appropriate IE in the DL-MAP.

6.3.10.3.1 Contention-based initial ranging and automatic adjustments

A SS that wishes to perform initial ranging shall take the following steps:

- The SS, after acquiring downlink synchronization and uplink transmission parameters with the BS/MR-BS/RS[1], shall select one Ranging Slot using the random backoff. The random backoff shall use a binary truncated exponent algorithm. After selecting the Ranging Slot, the SS shall choose a Ranging Code (from the Initial Ranging domain) using a uniform random process. The selected Ranging Code is transmitted ~~sent to the BS~~ (as a CDMA code) in the selected Ranging Slot.
- The BS/MR-BS/RS cannot tell which SS sent the CDMA ranging request; therefore, upon successfully receiving a CDMA ranging code directly or indirectly, the BS/MR-BS/RS[1] shall broadcast~~s~~ a ranging response message that 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 SS 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.
- Upon receiving a ranging response message with Continue status, the SS shall continue the ranging process as done on the first entry (using random selection rather than random backoff) with ranging codes randomly chosen from the initial ranging domain sent on the periodic ranging region.
- When the BS/MR-BS/RS directly or indirectly receives an initial-ranging CDMA code that requires no corrections, the BS/MR-BS/RS[1] shall provide BW allocation for the SS using the CDMA_Allocation_IE to send an RNG-REQ message. Sending the RNG-RSP message with status “Success” is optional.
- Initial ranging process is over after the SS receiv~~ing~~es an 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.
- If the RNG-RSP includes an Offset Frequency Adjustment pointing to another channel and it is larger than the value required for a channel bandwidth offset, the SS should synchronize with the new channel indicated in the RNG-RSP.
- The timeout required for SS to wait for RNG-RSP, following or not following CDMA Allocation IE, is defined by T3.
- Using the OFDMA ranging mechanism, the periodic ranging timer is controlled by the SS, not the BS/MR-BS/RS.

Adjustment of local parameters (e.g., Tx power) in an SS as a result of the receipt (or nonreceipt) of a RNG-RSP is considered to be implementation-dependent with the following restrictions:

a) All parameters shall be within the approved range at all times.

b) Power adjustment shall start from the initial value selected with the algorithm described in 6.3.9.5 unless a valid power setting is available from nonvolatile storage, in which case this value may be used as the starting point.

c) Power adjustment shall be capable of being reduced or increased by the specified amount in response to RNG-RSP messages.

d) If, during initialization, power is increased to the maximum value $P_{TX\_IR\_MAX}$ (without a response from the BS/MR-BS/RS) or to its maximum capability (without a response from the BS/MR-BS/RS), it shall wrap

[1] In this case, the RS must be non-transparent with a unique BSID.

back to the minimum.

On receiving an RNG-RSP, the SS shall not transmit until the RF signal has been adjusted in accordance with the RNG-RSP and has stabilized.

The message sequence chart (Table 205) and flow charts (Figure 109, Figure 110, Figure 111, Figure 112and Figure 113) on the following pages define the CDMA initial ranging and adjustment process that shall be followed by compliant SSs and BSs.

6.3.10.3.1.1 MR-BS and RS behavior during contention-based initial ranging

When an MS performs initial ranging in systems with transparent RSs, MR-BSs and transparent RSs shall perform the following tasks:

- A transparent RS shall monitor the Ranging Channel specified in the UL-MAP broadcasted by the MR-BS for initial ranging codes. When the transparent RS detects one or more codes in a frame, it shall send the codes it receives with sufficient strength and their adjustment information (e.g. time, power, frequency corrections) in an MR_Code-REP message on the RS basic CID to the serving MR-BS.
- When an MR-BS first receives a CDMA ranging code directly or via an MR_Code-REP, it shall set the T48 timer and wait for other MR_Code-REPs to arrive with the same ranging code attributes from other subordinate RSs. Once the T48 timer expires, the MR-BS shall determine the most appropriate path (direct or via an RS) on which to communicate with the MS that originated the code. Algorithms or policies to select the path are out of scope of this document.
- If adjustments are required, the MR-BS shall transmit the RNG-RSP to the MS and the process shall repeat. When the ranging code requires no further adjustment, the MR-BS shall provide an allocation in the access uplink for the MS to forward a RNG-REQ with its MAC address by inserting a CDMA_Allocation_IE in the UL-MAP. The MR-BS shall precede the CDMA_Allocation_IE with an UL_Burst_Receive_IE containing the access RS basic CID.
- A transparent RS, whose CID matches the RS basic CID of the UL_Burst_Receive_IE, shall receive the RNG-REQ on a burst specified by the CDMA_Allocation_IE and relay it to the MR-BS on the RS basic CID or management tunnel CID.

When an MS performs initial ranging in systems using non-transparent RSs with unique BSIDs and centralized scheduling, MR-BSs and non-transparent RSs shall perform the following tasks:

- The RS shall monitor the Ranging Channel specified in the RS UL-MAP created by the MR-BS for initial ranging codes.
- When the RS detects a ranging code, it shall determine whether or not adjustments are necessary. If adjustments are necessary, the RS shall request bandwidth on the access downlink on which to send a RNG-RSP to the MS by sending an RS CDMA ranging code (see code 1 in 6.3.10.3.5) or RS BR header to the MR-BS. The MR-BS shall create the necessary allocation in the RS DL-MAP and notify the RS of this allocation via an RS_BW_Alloc_IE in the DL-MAP. If adjustments are not necessary, the RS shall request bandwidth on the access uplink on which the MS can transmit a RNG-REQ containing its MAC address by following the procedure in 6.3.6.7.2.1.1. The MR-BS shall either insert a CDMA_Allocation_IE in the RS UL-MAP which the RS fills out before broadcasting and may allocate resources for the transmission of the RNG-RSP messages with status “Success”, or shall allocate resources for the transmission of the RNG-RSP messages with status “Abort” and downlink frequency override if necessary, according to the policies.
- Upon receiving the RNG-REQ containing the MS MAC address, the RS shall relay it to the MR-BS on its RS basic CID. The MR-BS shall send an RNG-RSP with the MS’s CID assignments to the RS on the RS basic CID, create an allocation in the RS DL-MAP where the RS can forward this message to the MS, and

notify the RS of this allocation by inserting an RS_BW_Alloc_IE in the DL-MAP. The RS shall relay this RNG-RSP to the MS on the initial ranging CID.

When an MS performs initial ranging in systems using non-transparent RSs with unique BSIDs and distributed scheduling, MR-BSs and non-transparent RSs shall perform the following tasks:

- The RS shall monitor the Ranging Channel specified in its UL-MAP. When the RS detects a ranging code, it shall perform adjustments directly with the MS as specified in 6.3.10.3.1 with no interaction from the MR-BS.
- When the RS receives a ranging code successfully, it may first request permission of the MR-BS for the MS to enter the network by sending an MR_Code-REP to the MR-BS. The MR-BS shall respond by sending an RNG-RSP to the RS containing number of accepted MSs.
- Once the RS receives permission to allow the MS to enter the network or if it decides to proceed without requesting permission, the RS shall provide bandwidth on the access uplink on which the MS can send an RNG-REQ containing its MAC address by inserting a CDMA_Allocation_IE in the UL-MAP.
- When the RS receives an RNG-REQ with an MS MAC address, it shall either assign CIDs to the MS or request them from the MR-BS. If the RS is in local CID allocation mode, it shall assign and forward CIDs to the MS via an RNG-RSP. If the RS is not in local CID allocation mode, it shall forward the RNG-REQ containing the MS MAC address to the MR-BS after removing the TLVs it manages. If the MS is accepted, the MR-BS shall assign CIDs and send them in a RNG-RSP to the RS on the RS basic CID. The RS shall then fill in the TLVs it manages and forward the RNG-RSP to the MS on the initial ranging CID.

When an RS performs initial ranging, MR-BSs and RSs shall follow the steps indicated by the type of system in previous sections of this subclause with the following modifications:

- Upon receiving a UCD message containing an RS_Initial_Ranging_Code TLV from the MR-BS/RS, the RS shall use the “RS Initial Ranging” code instead of the “Initial Ranging” code.
- After receiving an RS Initial Ranging code, the MR-BS/RS may send an RNG-RSP containing status = 2 (abort) with preamble indexes of candidate neighbor access stations.
- Upon receiving an RNG-RSP containing status abort with preamble indexes, the RS shall scan for a DL channel of candidate neighbor access stations and perform initial ranging.

The message sequence chart (Table 205a, Table 205b, Table 205c, Table 205d and Table 205e) and flow charts (Figure 115a, Figure 115b, Figure 115c, Figure 115d, Figure 115e, Figure 115f, Figure 115g, Figure 115h and Figure 115i) on the following pages define the CDMA initial ranging and adjustment process that shall be followed by compliant SSs, access RSs and MR-BSs.

[Move Table 199a to here, and modify it as following indicated]

Table ~~199a~~ 205a—Ranging and automatic adjustments procedure in transparent mode

*[Replace “*RNG-REQ *by “*MR_Code-REP*” from line 5 to line 30 of page 91 in this figure]*

[Delete "Status=Continue" at RS side in line 14 of page 91 in this figure]

[Delete "Status=Success" at RS side in line 27 of page 91 in this figure]

[Move the Table 199b, Table 199c and Table 199d to here, and modified them as indicated]

Table ~~199b~~ 205b—Ranging and automatic adjustments procedure in ~~MR~~ non-transparent mode with a unique BSID under centralized scheduling

*[Replace “*RNG-REQ*” by “*MR-Code-REP header*” in line 23 ~ 27 of page 95]*

[Replace "DL BW allocation to send RNG-RSP" by "RS_BW-ALLOC_IE" in the whole figure]

Table ~~199c~~ 205c—Ranging and automatic adjustments procedure in ~~MR~~ non-transparent mode with a unique BSID and distributed scheduling

Table ~~199d~~ 205d—Ranging and automatic adjustments procedure in non-transparent mode with a unique BSID and distributed scheduling with optional availability

Table ~~199e~~ 205e—Ranging and automatic adjustments procedure ~~with optional availability check at RS in MR mode~~ in non-transparent local CID allocation mode

[Merge Figure 95 with, Figure 108a and Figure 108h; then move it to here as following indicated:]

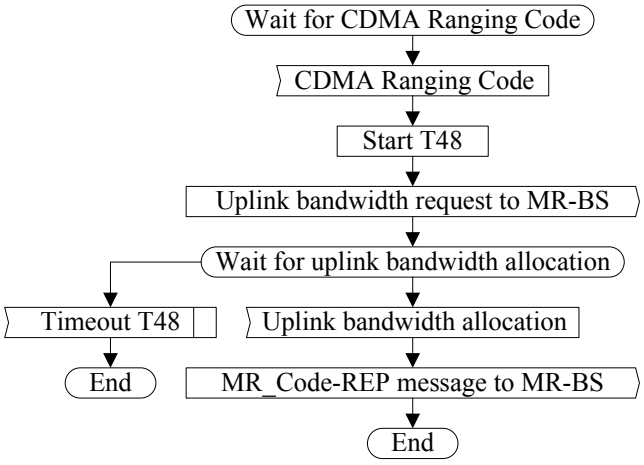


Figure 115a—Handling CDMA ranging code at a transparent RS

[Move Figure 95b to here and modified it as following indicated:]

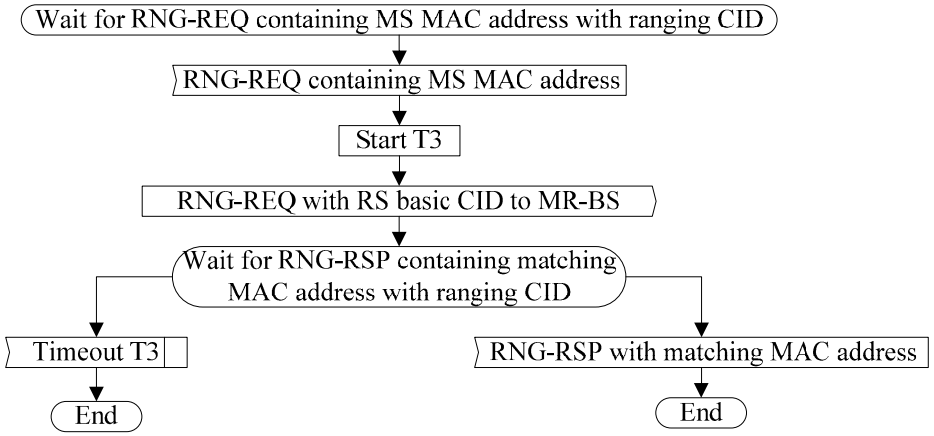


Figure 115b—Handling RNG-REQ at a transparent RS

[Move Figure 95g to here, and modified it as following indicated:]

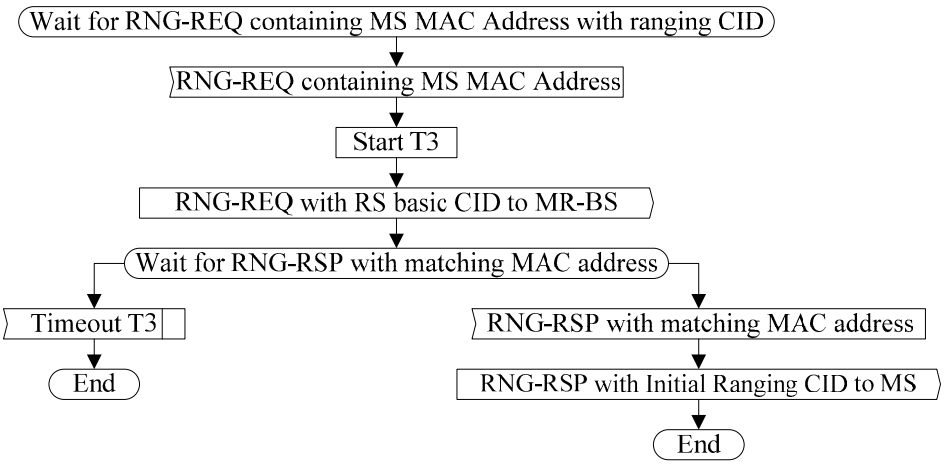


Figure 115c—Handling RNG-REQ at a non-transparent RS with a unique BSID and distributed scheduling

[Merge figure 95e with figure 95f, then move it to here, and modified as following indicated:]

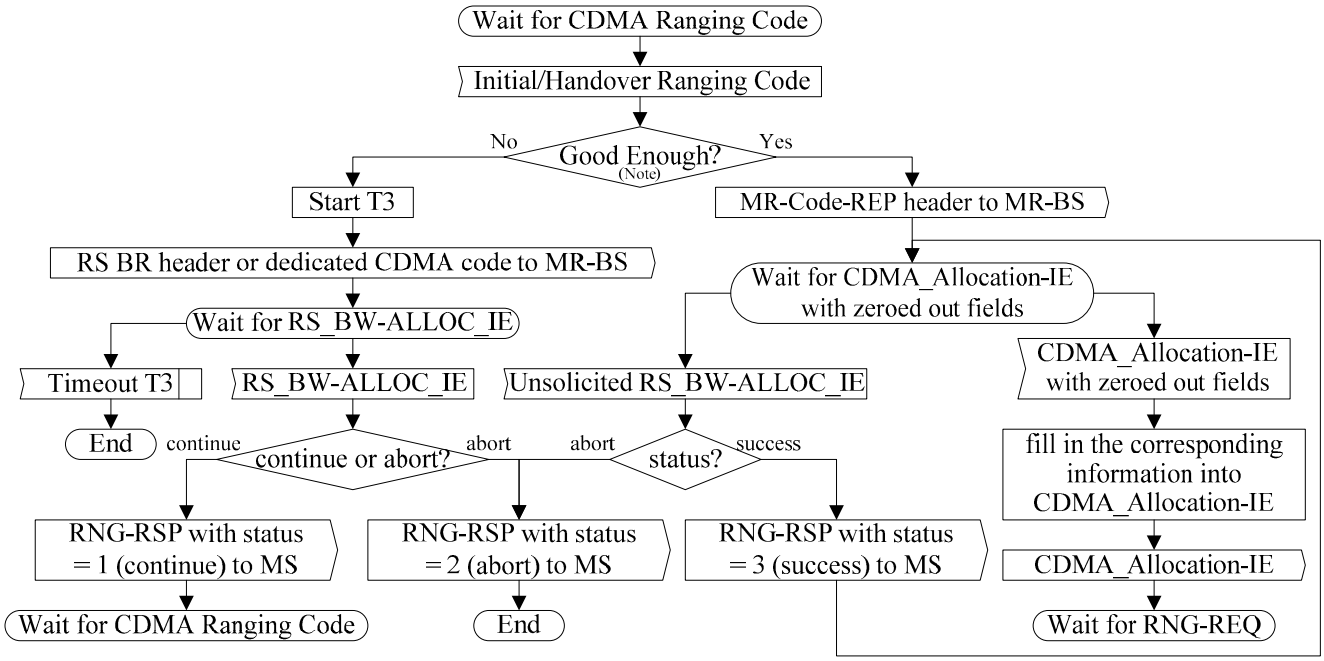


Figure 115d—Handling CDMA initial ranging code at a non-transparent RS with a unique BSID and centralized scheduling

[Move Figure 108d to here, and modified it as following indicated:]

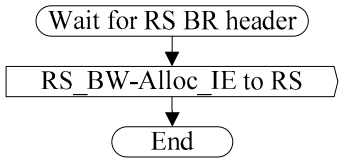


Figure 115e— Handling RS_BR header at an MR-BS

[Merge Figure 95c with Figure 108b and Figure 108i; then move it to here as following indicated:]

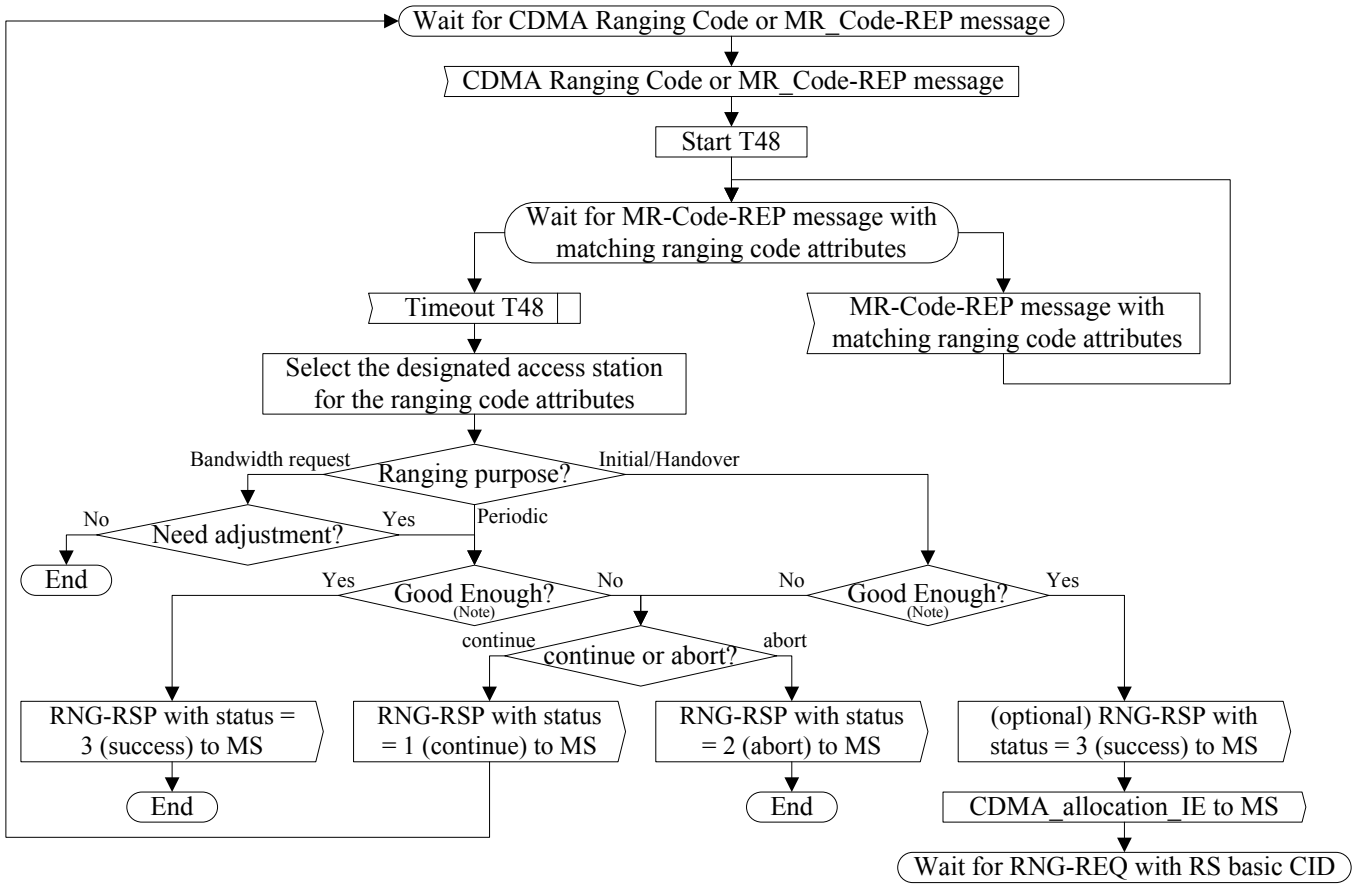


Figure 115f—Handling CDMA ranging code or MR_Code-REP message at an MR-BS

NOTE —Means ranging is within the tolerable limits of the BS.

[Move Figure 95h to here, and modified it as following indicated:]

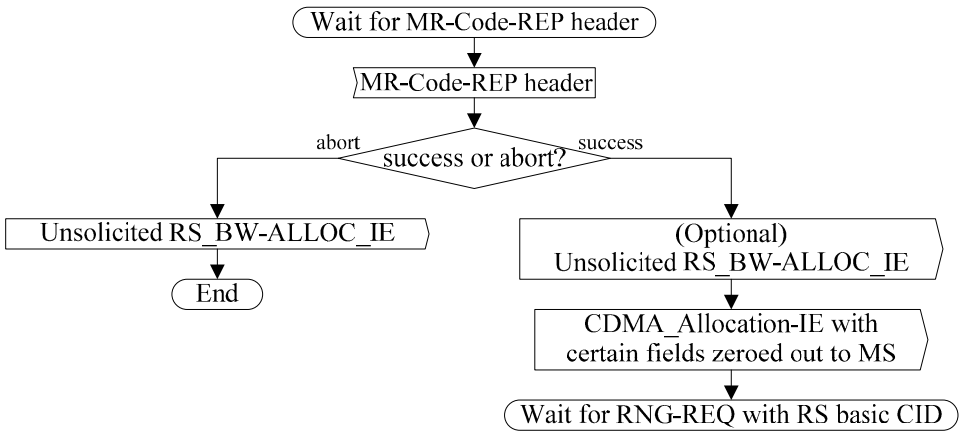


Figure 115g Handling MR_Code-REP at MR-BS

[Inserted the following subclause as indicated:]

6.3.10.3.2 Periodic ranging and automatic adjustments

An SS that wishes to perform periodic ranging shall take the following steps:

— The SS shall choose randomly a Ranging Slot (with random selection with equal probability from

available Ranging Slots in a single frame) at the time to perform the ranging, then it chooses randomly a Periodic Ranging Code and sends it to the BS/MR-BS/RS[2] (as a CDMA code).

- If the SS does not receive a response, the SS may send a new CDMA code at the next appropriate periodic ranging transmission opportunity and adjust its power level up to $P_{TX\_IR\_MAX}$ (6.3.9.5.1).
- The BS/MR-BS/RS cannot tell which MS sent the CDMA ranging request; therefore, upon successfully receiving a CDMA periodic ranging code directly or indirectly, the BS/MR-BS/RS[3] broadcasts a ranging response message that advertises the received periodic ranging code as well as the ranging slot (OFDMA symbol number, subchannel, etc.) where the CDMA periodic ranging code has been identified. This information is used by the SS that sent the CDMA periodic 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.
- Upon receiving a Ranging Response message with continue status, the SS shall continue the ranging process with further periodic ranging codes randomly chosen. Upon receiving a RNG-RSP message with success status, the MS shall restart timer T4.
- Using the OFDMA ranging mechanism, the periodic ranging timer is controlled by the SS, not the BS/MR-BS/RS.
- The BS/MR-BS/RS[2] may send an unsolicited RNG-RSP as a response to a CDMA-based bandwidth-request or any other data transmission from the SS directly or indirectly.

Upon timeout of MS internal T4 timer, the SS shall perform Periodic Ranging according to procedure above.

When the SS receives an unsolicited RNG-RSP message, it shall reset the periodic ranging timer and adjust the parameters (timing and power, etc.) as notified in the RNG-RSP message.

The flow charts (Figure 116, Figure 117, and Figure 118) and message sequence chart (Table 206) on the following pages define the CDMA periodic ranging and adjustment process that shall be followed by compliant SSs and BSs.

6.3.10.3.2.1 MR-BS and RS behavior during periodic ranging

When an MS initiates periodic ranging in systems with RSs, MR-BSs and RSs shall perform the same tasks outlined in subclause 6.3.10.3.1.1 (depending on the type of system) with the following modifications:

- Periodic ranging codes are used instead of initial ranging codes.
- The process stops once the access station receives the code information and forwards an RNG-RSP to the MS.

When an RS initiates periodic ranging, the MR-BSs and RSs shall perform the same tasks outlined in subclause 6.3.10.3.1.1 (depending on the type of system) with the following modifications:

- Periodic ranging codes are used instead of initial ranging codes. Also, the MR-BS may assign a dedicated periodic ranging code to the RS.
- The process stops once the access station receives the code and forwards an RNG-RSP to the RS.

In some cases, the superordinate station of an MS/RS may want to initiate ranging based on the channel measurements from data traffic or a CDMA-based bandwidth request ranging code received from the MS/RS. To initiate the periodic ranging process, the superordinate station shall send an unsolicited RNG-RSP to the MS/RS. If the superordinate station is a transparent RS relaying on the uplink only, it shall transmit an RNG-REQ to the MR-BS on the RS basic CID or management tunnel CID to request that the MR-BS send an unsolicited RNG-RSP with the necessary adjustments to the MS. If the superordinate station is a non-

[2] In this case, the RS must be non-transparent with a unique BSID

[3] In the case of non-transparent RS with a unique BSID under centralized BW allocation, the MR-BS creates this allocation on behalf of the RS.

transparent RS in centralized scheduling mode or a transparent RS relaying on both uplink and downlink, it shall request bandwidth from the MR-BS on which to send the unsolicited RNG-RSP (see 6.3.6.7.2.1). If the superordinate station is a non-transparent RS in distributed scheduling mode, it shall send the RNG-RSP directly to the MS without interaction with the MR-BS.

The flow charts (Figure 115a, Figure 115b, Figure 115e, Figure 118a, Figure 118b, Figure 118c and Figure 118d) and message sequence chart (Table 206a and Table 206b) on the following pages define the CDMA periodic ranging and adjustment process that shall be followed by compliant SSs, transparent access RSs and MR-BSs.

[Move Table 201a to here, and modify it as following indicated]

Table ~~201a~~ 206a—Ranging and automatic adjustment procedure in transparent ~~RS system~~ mode

[Replace "RNG-REQ" by "MR_Code-REP" in the whole figure]

[Delete "Status=Continue" at RS side in line 13 of page 110]

[Delete "Status=Success" at RS side in line 24 of page 110]

[Move Table 201b to the subclause 6.3.10.3.7.2, and modify it as following indicated]

Table ~~201b~~ 206a—Ranging and automatic adjustment procedure in non-transparent ~~RS systems~~ mode with a unique BSID under ~~(~~centralized~~)~~ scheduling mode

[on page 112, line 10, 12, 23, 24, 36, and 52 replace "RS BR Header: with "dedicated RS CDMA code/RS BR Header"]

[Replace "DL BW allocation to send RNG-RSP" by "RS_BW-Alloc_IE in whole Table 201b]

Table ~~201c~~ 206b—Ranging and automatic adjustment procedure in non-transparent ~~RS systems~~ mode with a unique BSID under distributed scheduling

[Merge Figure 108c, and then move it to here as following indicated:]

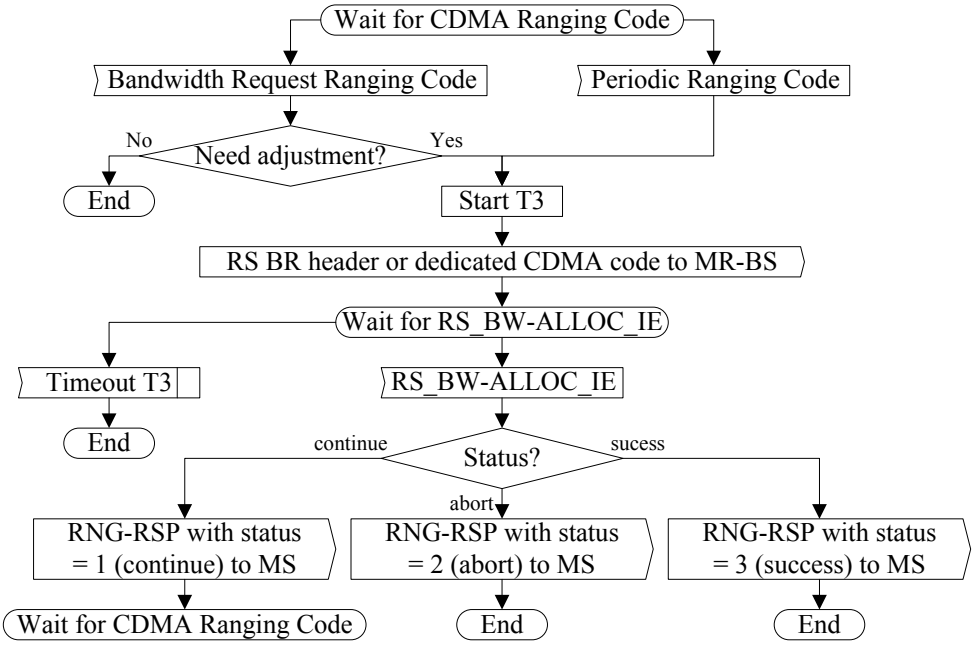


Figure 118a Handling CDMA ranging code at a non-transparent RS with a unique BSID and centralized scheduling

[Move Figure 108f to here, and modify it as following indicated]

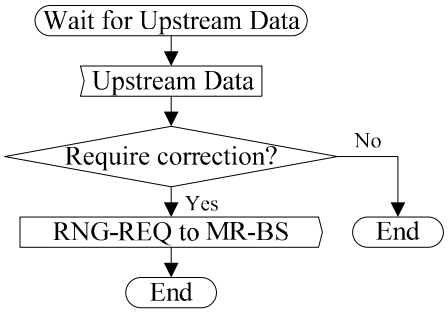


Figure 118b—MS upstream transmission adjustment at an uplink-only transparent RS

[Merge Figure 108f with Figure108j, move it to here, and modify it as following indicated]

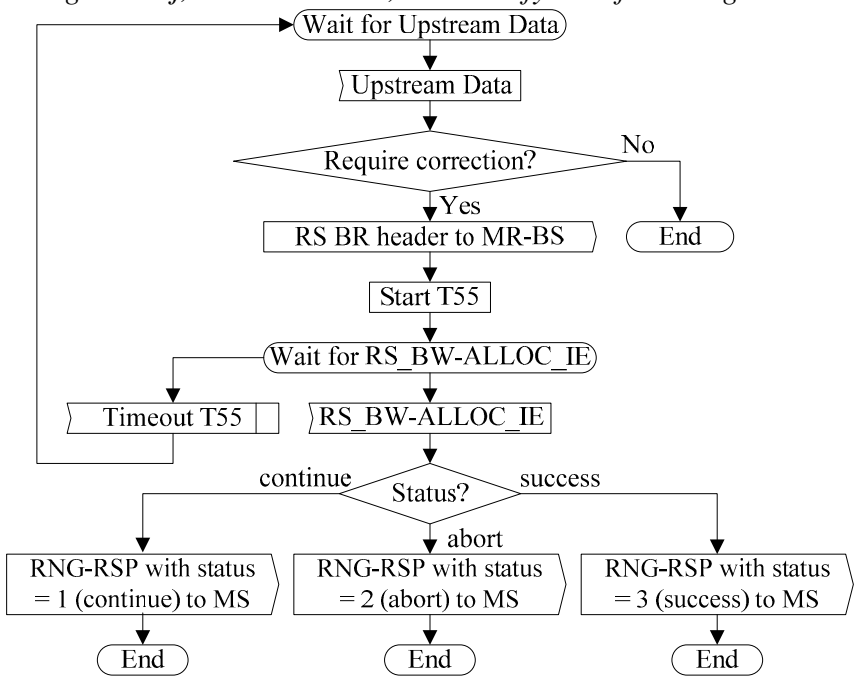


Figure 118c—MS upstream transmission adjustment at a RS with a unique BSID and centralized scheduling

[Move Figure 108f and modify it as following indicated]

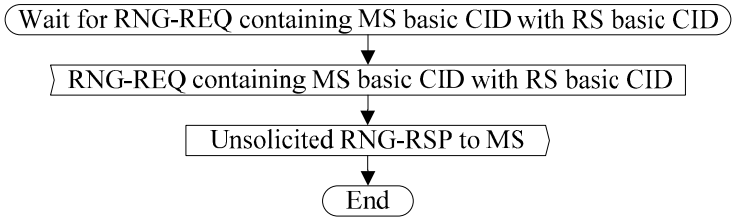


Figure 118d—Handle Handling RNG-REQ at an MR-BS

[Modified the following subclause as indicated:]

6.3.10.3.3 CDMA HO ranging and automatic adjustment

An MS that wishes to perform HO ranging shall take a process similar to that defined in the initial ranging section with the following modifications.

In CDMA HO ranging process, the random selection is used instead of random backoff and the CDMA HO ranging code is used instead of the initial ranging code. The code is selected from the HO ranging domain as defined in 8.4.7.3.

Alternatively, if the BS/MR-BS is prenotified ~~for~~ of the upcoming HO MS, it may provide bandwidth ~~allocation~~

~~information to~~ for the MS to send an RNG-REQ by using the Fast Ranging IE ~~to send an RNG-REQ message~~. If the MS's superordinate station is a non-transparent RS with unique BSID and scheduling is centralized, the MR-BS shall insert this IE in the RS UL-MAP and provide bandwidth along the relay route on which to forward the RNG-REQ to the MR-BS. If the MS's superordinate station is a transparent RS, the MR-BS shall insert the Fast-Ranging_IE in the UL-MAP and precede the Fast Ranging IE with an UL_Burst_Receive_IE assigned to the RS basic CID. When a transparent RS finds its RS basic CID in an UL_Burst_Receive_IE, it shall look for the RNG-REQ on the burst specified by the Fast Ranging IE that follows the UL_Burst_Receive_IE and relay the RNG-REQ to the MR-BS on the RS basic CID.

[Delete the subclause 6.3.9.16.1, 6.3.9.16.2 and 6.3.9.16.4.2 as following indicated]

~~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~~

~~6.3.9.16.4.2 MS network entry procedure for localized non-transparent RS~~

[Delete the subclause 6.3.10.3.4.1, 6.3.10.3.4.2, 6.3.10.3.4.3, 6.3.10.3.4.4, 6.3.10.3.4.5, 6.3.10.3.4.6 as following indicated]

~~6.3.10.3.4.1 MS periodic ranging and automatic adjustments in transparent RS systems~~

~~6.3.10.3.4.2 MS periodic ranging and automatic adjustments in non-transparent RS systems~~

~~6.3.10.3.4.3 Unsolicited RNG-RSP in transparent RS systems~~

~~6.3.10.3.4.4 Unsolicited RNG-RSP in non-transparent RS systems~~

~~6.3.10.3.4.5 MS CDMA handover ranging and automatic adjustment in RS system~~

~~6.3.10.3.4.6 RS periodic ranging and automatic adjustments with the access station~~

[Change the text starting on page 88 line 7as follows:]

Insert the following text ~~after the second paragraph~~ at the end of 6.3.9:

For an MR network the MS network entry procedure steps (a)-(c) are defined in 6.3.10.3.1. The remaining MS network entry steps (d)-(j) are the same as those defined above with the exception that the messages may be relayed by one or more RSs.

The procedure for initialization of an RS shall be as shown in Figure 72a. For the RS ~~the~~ stages g), h), i) and j) in ~~the~~ figure 55 are not required.~~, for all other stages t~~The RS shall behave in the same manner as an SS during all other stages of the network entry process unless otherwise specified in the subclauses of 6.3.9. The more detailed finite state machine representations of the individual sections (including error paths) and the timeout values shall be the same as those provided for the SS, unless otherwise specified.

8.4.5.9.3 RS Bandwidth Allocation IE (RS_BW-ALLOC_IE)

[Change the following table in line 38 of page 193 as indicated]

Table 496e—RS_BW-ALLOC_IE format

Name	Length	Description
RS_BW-ALLOC_IE {	-	-
Type	5 bits	0x01
Length	4 bits	variable
RCID_IE()	4,8,12,16 bits	RS basic CID in RCID_IE format (see 8.4.5.3.20.1)
Type	1 bit	0b0: Response for RS BR header 0b1: For RS broadcasting RNG-RSP
If (Type == 0x0) {	-	-

TID	4 bits	Transaction ID
} else if (Type == 0x1) {	-	-
Frame Number Index	4 bits	LSBs of relevant frame number
Number of rejected MS	4 bits	Number of rejected MS (i.e. RNG-RSP message with status “Abort”)
INC_RNG_SUC	1 bit	Include bandwidth for RNG-RSP message with status “success” (0b0: no, 0b1: yes)
INC_DFO	1 bit	Include bandwidth for RNG-RSP message containing downlink frequency override (0b0: no, 0b1: yes)
}	-	-
DL-MAP IE index	8 bits	RS shall transmit message on the burst described by the k-th DL-MAP IE within the DL-MAP message broadcasted by the RS, where *k* is the DL-MAP IE index
}	-	-

10.1 Global values

[Modified the following Table 583 in line 9 of page 202 as indicated:]

Table 583—Parameters and constants

System	Name	Time reference	Minimum value	Default value	Maximum value
MR-BS	T48	Wait for ~~RNQ-REQ~~ MR_Code-REP message from the subordinate RS	tbd	~~tbd~~ $T48_{CDMA}$ = TBD. $T48_{Message} = T48_{CDMA} - T_{FD} \times ((FN_{Rx} - FN_{Msg}) \bmod 256)$, where T_{FD}: the frame duration, FN_{Rx}: the relevant frame number when receiving message, FN_{Msg}: the frame number in the received message	T3

[Add a new TLV to Table 616]

Table 616—RNG-RSP message encodings

Name	Type (1 byte)	Length	Value (variable-length)
Number of accepted MSs	TBD	1	Bit 0~3: Number of accepted new entry MS Bit 4~7: Number of accepted handover MS