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Re:	IEEE 802.16j-06/034: " Call for Technical Proposals regarding IEEE Project 802.16j"
Abstract	This contribution describes the MAC procedure for supporting MS handover in Transparent RS.
Purpose	This contribution is submitted for discussion and adoption in 802.16j.
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MS Handover support in Transparent RS

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1 Introduction

In response to the IEEE 802.16j TG Call for Technical Contributions, this document proposes a MAC procedure in order to support MS handover in transparent RS.

In a MMR cell, there exist different types of RS because of the different usage scenario^[1]. From the MS point of view, we can define 2 types of RS. One is the transparent RS, which doesn't transmit preamble and MAP signal, or just transmit the same preamble and MAP signal with its superior anchor station, the other is Non-transparent RS, which generate and send its own preamble and MAP signal. So, Non-transparent RS act as a BS to MS, and MS can not sense the existence of transparent RS at all. Because Non-transparent RS can generate its own MAP information, so Non-transparent is a high capability RS, and has the ability of resource scheduling, it can be the anchor station of a transparent RS (anchor station controls its subordinate transparent RS).

According to different type of access node of MS, several different type of handover can be defined. As shown in Figure 1.

Inter-MMRBS Handover: the serving access node and the target access node belong to different MMR-BS.

Intra-MMRBS Handover: the serving access node and the target access node belong to the same MMR-BS.

Inter-RS Handover: the serving access node and the target access node belong to the same MMR-BS, but the different anchor station. That is, from the MS point of view, it recognizes the serving access node and the target access node as different BS.

Intra-RS Handover: the serving access node and the target access node belong to the same MMR-BS, and the same anchor station. That is, MS can not sense the handover at all.

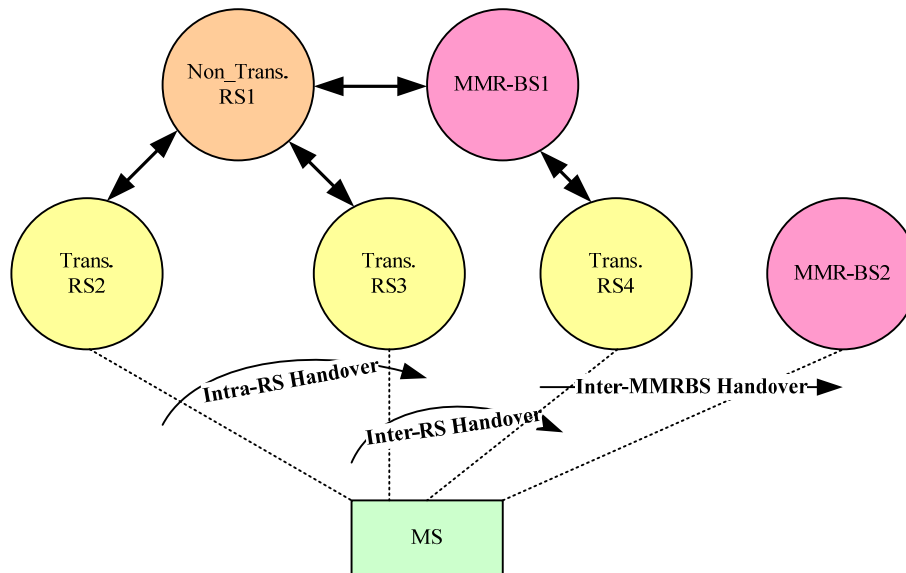


Figure 1 Handover scenario definition

From the definition above, Intra-RS and Inter-RS handover are 2 special case of Intra-MMRBS handover. This contribution will discuss the Intra-RS handover in detail.

2 Problem Statement

In Inter-RS / Inter-MMRBS handover scenario, MS can sense the handover procedure, so the legacy 16e handover mechanism can be reused with some modification for these scenarios. However, in Intra-RS handover scenario, MS can not sense the handover at all. So, a new handover mechanism should be defined for this scenario, in order to support the MS handover in transparent RS.

In intra-RS handover scenario, no downlink signal can be used to trigger the intra-RS handover as legacy 16e, because MS can not sense the transparent RS. Moreover, from MS point of view, there is no difference between the serving access node and the target access node. So, MS can not initial the intra-RS handover procedure, and there is no need for MS to participate the handover procedure. The whole handover procedure can only be fulfilled and managed at anchor station and MMR-BS.

Because MS can not sense the intra-RS handover procedure, it's very important to have a reliable and fast intra-RS handover mechanism, so as to not deteriorate the QoS of MS.

3 Proposed Handover MAC Procedure

3.1 Intra-RS Handover

3.1.1 Principle of the Intra-RS handover

In order to provide a reliable and fast intra-RS handover, for each MS a candidate station set is established in its anchor station. The candidate station set (CASS) is defined as an aggregate transparent RS belonging to the same anchor station (including anchor station itself), and can reach the MS. When a MS moving across the transparent RSs belong to the same anchor station, intra-RS handover occurs. Then a new access station should be selected from the candidate station set and assigned to the MS. A new MAC management message should be defined, in order to terminate the old access station and start up the new access station. After indicated by the anchor station via MAC management message, the new assigned access station will take on the relaying function for the MS. So the intra-RS handover procedure is actually the procedure of assign a new access station for the MS in the candidate station set which is obviously transparent to MS.

The fundamental problem of intra-RS handover is how to establish the candidate station set and how to dynamic update the candidate station set.

3.1.2 Establishment of candidate station set

The candidate station set can be established in the anchor station during MS network entry / reentry, or inter-RS / inter-MMRBS handover procedure.

In MS network entry procedure, CDMA code ranging is performed firstly. The transparent RSs who have received the CDMA initial ranging code will report to their anchor station, although no one can tell which MS send this CDMA code at this stage. The anchor station logs all the ranging report it received. After the success of the CDMA code ranging procedure, RNG-REQ message is sent from the MS with its MAC address, then MMR-BS can identify the MS, and allocate CID for it. So the anchor station can associate the received ranging report with MS, and establish the candidate station set for the MS. Moreover, the most suitable RS is selected from the candidate station set as MS's access station. This procedure is shown in Figure 2.

In inter-RS / inter-MMRBS handover procedure, the establishment of candidate station set is similar with that in initial network entry procedure. The major difference is that MS can use dedicated ranging channel instead of contention based ranging channel. The anchor station can identify the MS from the received CDMA code and ranging region. So the candidate station set can be established as soon as the ranging report is received.

In summary, the candidate station set is established based on the monitoring of MS's CDMA ranging code signal and the report to the anchor station.

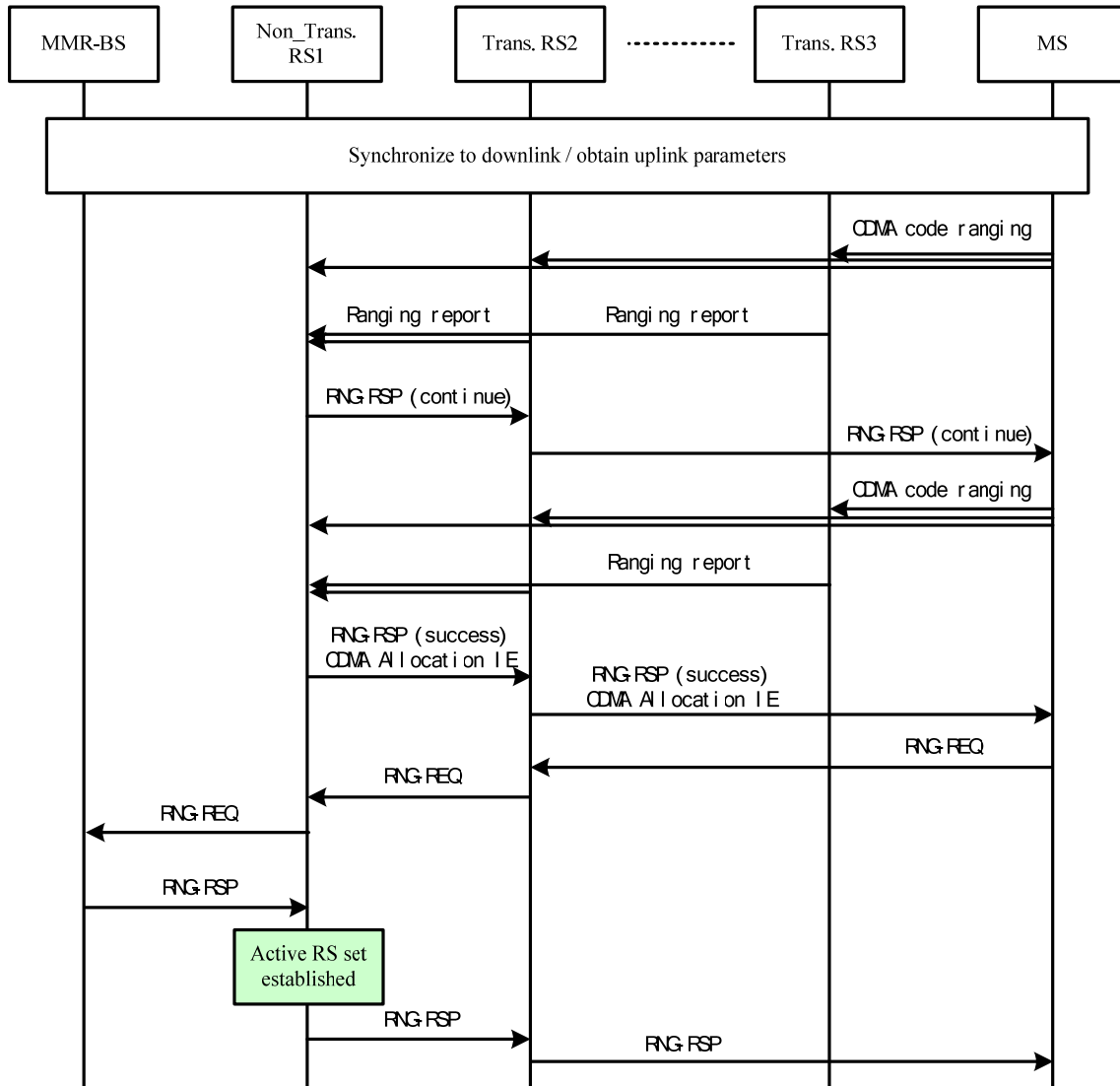


Figure 2 Candidate station set establish procedure during MS network entry

3.1.3 Dynamic update of candidate station set

There are 2 ways to update the candidate station set in order to provide a reliable and fast intra-RS handover, one is the active updating controlled by anchor station or MMR-BS, the other is passive updating triggered by the monitoring report of the uplink signal.

In passive updating mode, all the RS will monitor MS's uplink signal, when a RS detect a new MS's uplink signal (SINR or RSSI, etc.) exceed Add threshold, or MS's uplink signal fall below the Del threshold, the RS will generate report information to the anchor station. The anchor station will use this report information to update the candidate station set.

In active updating mode, anchor station will send unsolicited UL_Sounding_Command_IE defined in 16e to MS in order to initiate MS reporting its channel quality. When MS reporting its channel quality or transmitting a unicast signal, all the RS can monitor this uplink signal and report to its anchor station. The candidate station set is updated according to the uplink signal monitoring report. The triggering of the active updating can be timers expire, or anchor station makes decision according to its strategy.

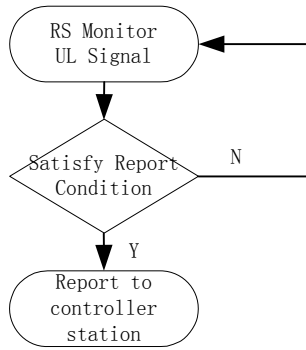


Figure 3 RS monitoring MS's uplink signal dialog (RS side)

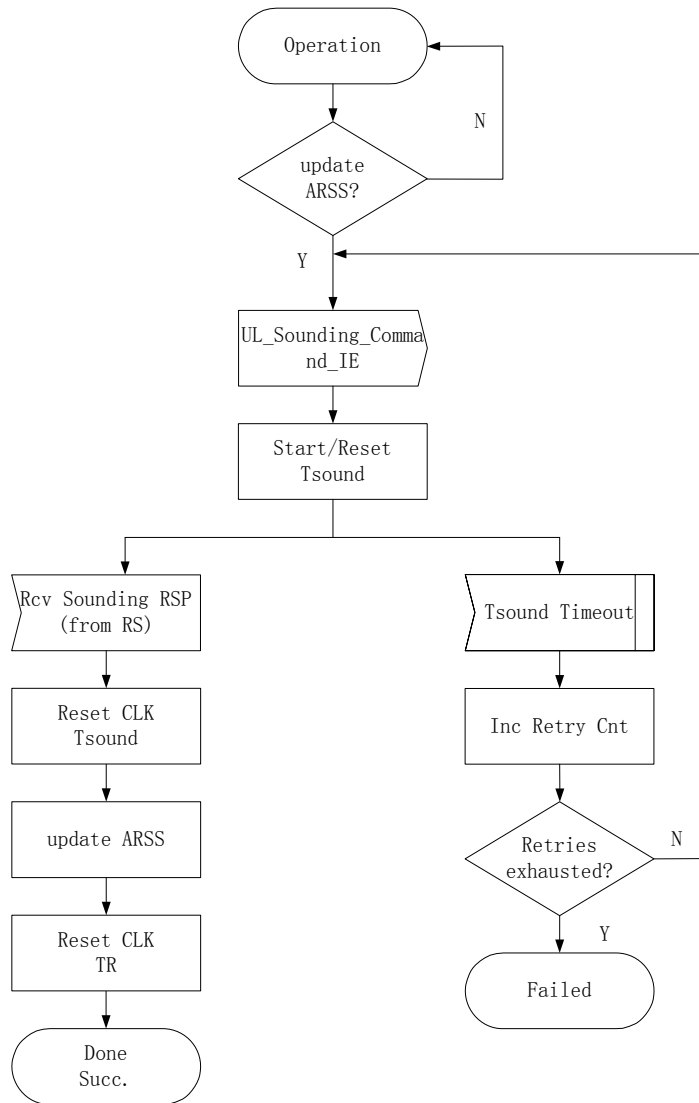


Figure 4 CASS update message dialog (anchor station side) - Anchor station initiated

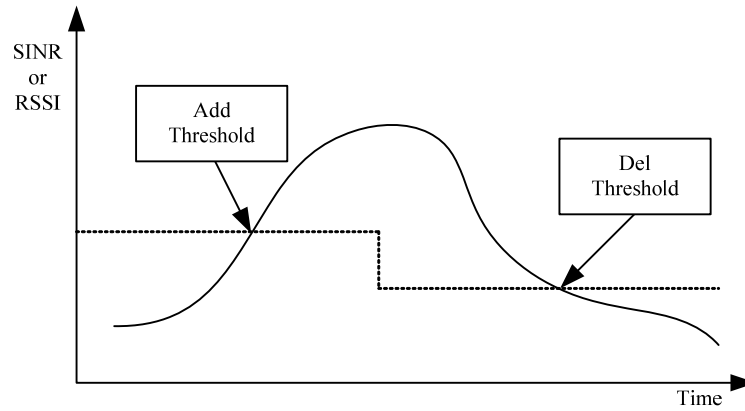


Figure 5 candidate station set update threshold

3.2 Inter-RS / Inter-MMRBS Handover

When inter-Bs or inter-MMRBS handover occurs, candidate station set needs to be established in the target anchor station. If no transparent RS associate with the target anchor station, the candidate station set can be simplified. At case of MDHO and FBSS, multiple candidate station set need to be established in the correspondence anchor stations.

4 Text Proposal

[Insert new subclause 6.3.22.4.1]

6.3.22.4.1 MS handover support in transparent RS

In order to provide a reliable and fast intra-RS handover, for each MS an candidate station set is established in its anchor station. The candidate station set (ARSS) is defined as an aggregate transparent RS belong to the same anchor station (including anchor station itself), and can reach the MS. When a MS moving across the transparent RSs belong to the same anchor station, intra-RS handover occurs. Then a new access station should be assigned to the MS according to the candidate station set, and the new assigned access station will take on the relaying function for the MS. So the intra-RS handover procedure is actually the procedure of assign a new access station for the MS in the candidate station set which is obviously transparent to MS.

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In summary, the candidate station set is established based on the monitoring of MS's CDMA ranging code signal and the report to the anchor station.

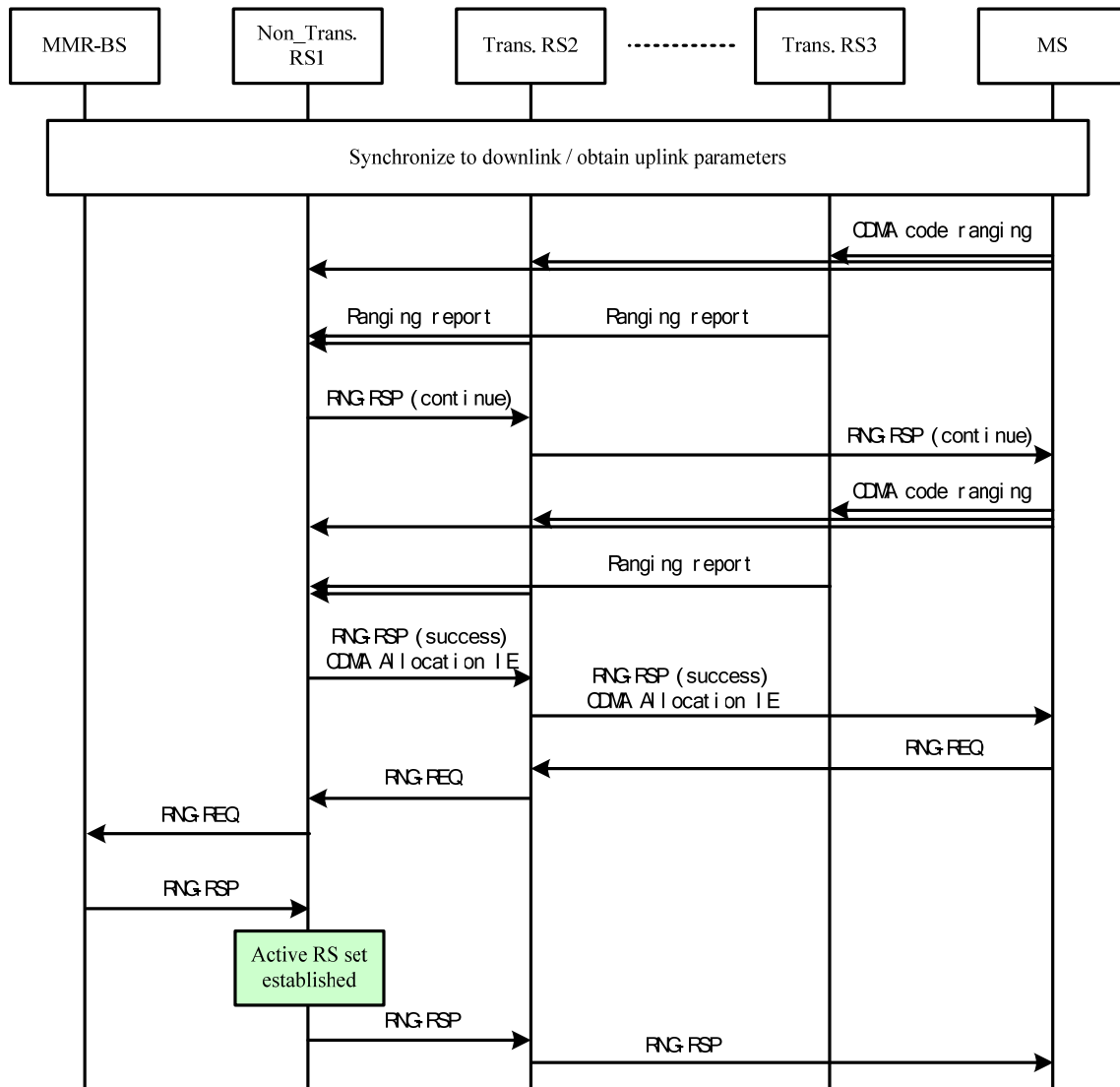


Figure 6 Candidate station set establish procedure during MS network entry

There are 2 ways to update the candidate station set in order to provide a reliable and fast intra-RS handover, one is the active updating controlled by anchor station or MMR-BS, the other is passive updating triggered by the monitoring report of the uplink signal.

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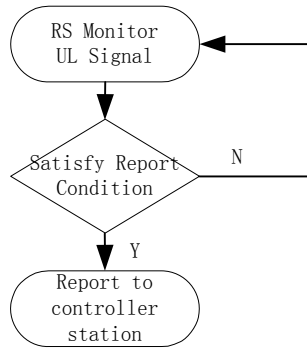


Figure 7 RS monitoring MS's uplink signal dialog (RS side)

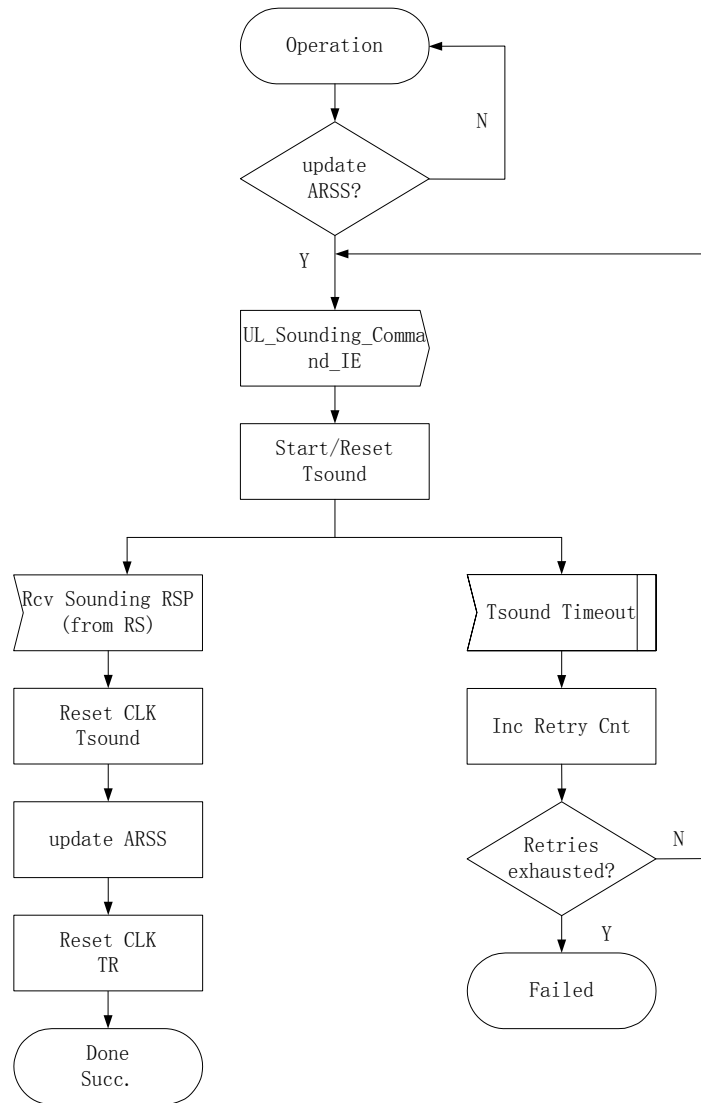


Figure 8 Candidate station set update message dialog (anchor station side) - anchor station initiated

5 References

[1] Jerry Sydir, et al., Harmonized Contribution on 802.16j (Mobile Multihop Relay) Usage Models, IEEE 802.16j-06/015.