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Title	Clarification of CDMA handover ranging process
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Source(s)	<p>Haiming Huang, Kemin Li, Titus Lo Walbell Technologies, Inc., USA <a href="mailto:tlo@walbell.com">tlo@walbell.com</a> Voice: +425-451-8278</p> <p>Yerang Hur, Seokchan Lee, Jungnam Yun, Bongho Kim, Jaehyeong Kim Posdata Corporation, S. Korea</p> <p>Mary Chion ZTE</p>
Re:	Response to IEEE 802.16e Sponsor Ballot
Abstract	This document suggests changes in TGe Draft Document IEEE 802.16e-D5 to add CDMA handover ranging process description and modify UL-MAP-IE to indicate CDMA handover ranging slot/symbol.
Purpose	Adopt into the current TGe working draft
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# Clarification of CDMA Handover Ranging Process

*Haiming Huang, Kemin Li, Titus Lo*

*Walbell Technologies, Inc.*

*Yerang Hur, Seokchan Lee, Jungnam Yun, Bongho Kim, Jaehyeong Kim*

*Posdata Corporation*

*Mary Chion*

*ZTE*

## 1. Motivation

In TGe Draft Document IEEE 802.16e-D5, direct and indirect statements about the CDMA handover ranging process can be found in different places. For example, in section 8.4.7.3, it is stated that the CDMA handover ranging code and the CDMA initial ranging code should be selected from two different code domains. In Section 8.7.3.1 it is implied in that the CDMA handover ranging process may follow the CDMA initial ranging process. However, there is no clear, coherent, and explicit definition for the CDMA handover ranging process. Such lack of clarity causes uncertainty and confusion about the process. The problem manifests itself largely in the following three instances.

1. The ranging slot definition in Table 285 does not indicate the required CDMA handover ranging slot. The remedy is to add explicit text to specify the CDMA handover ranging slot.
2. It is necessary that the CDMA handover ranging process should be a different process from CDMA initial ranging process because this enables the BS to distinguish the two to carry out follow-up operations accordingly. However, based on the existing specifications, the BS may not be able to do so in some cases. For example, during the ranging process, the BS sends a RNG-RSP with Continue status to the MSS if the reception of the first CDMA code has been corrupted. Consequently, the MSS will send another CDMA periodic ranging code. At that point the BS will lose track of the status of the incoming ranging code if both handover ranging MS and initial ranging MS all select the second ranging code from periodic ranging code domain. To address this issue, it is proposed that an MSS in the CDMA handover state shall use the CDMA handover code instead of periodic code when it receives the RNG-RSP with Continue status.
3. In the initial ranging process, the ranging power level at an MSS is being ramped up when there is no response from the BS. When the ranging power level reaches the maximum, it shall be reset to start at the minimum. However, in handover ranging process, if there is no response from the BS, it is most likely caused by an error. Therefore, it is recommended that the MSS cancel the handover process if its ranging power reaches the maximum level.

## 2. Specific Changes Suggested to TGe Draft Document IEEE P802.16e-D5

### Remedy 1:

[Add the following section after 6.3.10.3.2 in the baseline document]

#### 6.3.10.3.3 CDMA handover ranging and automatic adjustment

An MSS that wishes to perform handover ranging shall take the following steps,

— The MSS, after acquiring the downlink synchronization and uplink transmission parameters, shall choose randomly a Ranging Slot (with the use of a binary truncated exponent algorithm to avoid possible re-collisions) as the time to perform the ranging. Subsequently, it chooses randomly a Ranging Code (from the Handover Ranging domain) and sends it to the BS (as a CDMA code).

— Upon successfully receiving a CDMA Ranging Code from an MSS, the BS broadcasts a Ranging Response message that advertises the received Ranging Code as well as the ranging slot (i.e., OFDMA symbol number, subchannel, etc.) where the CDMA Ranging code has been identified. This information is used by the MSS that has sent the CDMA ranging code to identify the Ranging Response message corresponding to its ranging request. The Ranging Response message contains all the necessary adjustments (e.g., time, power and possibly frequency corrections) and a status notification.

— When the BS receives a handover-ranging CDMA code that results in sending an RNG-RSP message with success status, the BS may provide BW allocation for the MSS using the CDMA\_Allocation\_IE to send an RNG-REQ message.

Alternatively, if the BS is pre-notified for the upcoming handover MSS, it may provide BW allocation information to the MSS using Fast\_Ranging\_IE to send an RNG-REQ message.

— Upon receiving the Ranging Response message with Continue status, the MSS shall continue the ranging process as being done on the first entry with ranging codes randomly chosen from the Handover Ranging domain.

The adjustment of local parameters (e.g., transmit power) in an MSS as a result of the receipt (or nonreceipt) of an 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) The 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 a nonvolatile storage, in which case this value may be used as the starting point.
- c) The power adjustment shall be capable of being reduced or increased by the specified amount in response to RNG-RSP messages.
- d) If, during the handover ranging process, power is increased to the maximum value (without a response from the BS) it shall cancel the HO process.

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

**Remedy 2:**

[Modify Table 285-OFDMA UL-MAP IE format (row 9) as follows:]

**Table 285 – UL-MAP-IE Message Format**

Syntax	Size	Notes
Ranging Method	2 bits	0b00 - Initial Ranging/ <b>Handover Ranging</b> over two symbols 0b01 - Initial Ranging/ <b>Handover Ranging</b> over four symbols 0b10 - BW Request/Periodic Ranging over one symbol 0b11 - BW Request/Periodic Ranging over three symbols