# MS network entry for non-transparent Relay Station

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**Re:** | IEEE802.16j-06/027: “Call for Technical Proposals regarding IEEE802.16j”
**Abstract** | This contribution proposes MS network entry procedures and additional TLVs in non-transparent Relay Station systems.
**Purpose** | To propose text to describe MS network entry in non-transparent Relay Station systems
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MS network entry for non-transparent Relay Station

Masato Okuda, Antoni Oleszczuk and Mike Hart

Introduction

This contribution proposes MS network entry procedures and additional TLVs in non-transparent Relay Station systems. A non-transparent RS transmits its own preamble, DL-MAP and UL-MAP. Therefore, a MS recognizes it as a BS. The non-transparent RS has two types, centralized and distributed scheduling. The centralized scheduling type RS does not create DL-MAP and UL-MAP by itself. Instead, its associated MR-BS creates and sends them to the RS, and the RS broadcasts them on its access link. The distributed scheduling type RS creates MAPs by itself and broadcasts them to MS.

The MR-BS has MS management and connection management function in order to simplify RS function. Therefore, the intermediate RS basically relays MAC management messages between the MR-BS and MS except for some additional function. In order for the MR-BS to manage network entry procedure of a MS under a RS, the RS and the MR-BW are required to exchange MAC management messages with new TLVs.

This contribution describes detail message sequences and RS/MR-BS behavior in addition to new TLV.

Specific Text Changes

Insert the new subclause 6.3.9.16.2 (Support for network entry and initialization in relay mode):

6.3.9.16.2 MS network entry procedures in non-transparent RS systems
6.3.9.16.2.1 Non-transparent RS with Centralized scheduling

In MS network entry procedures in non-transparent RS systems, MS scans for downlink channel and establish synchronization with the non-transparent RS, then obtains transmit parameters from UCD message as described in 6.3.9.1 through 6.3.9.4.

The initial ranging process shall begin by sending an initial-ranging CDMA codes on the UL allocation dedicated for that purpose (for more details see 6.3.10.3).

Once a RS receives the CDMA code, it transmits a RNG-REQ with the RS basic CID to the MR-BS, containing ranging status, ranging code attributes and MS ranging indicator. The RNG-REQ may also contain adjustment information, such as frequency, timing and power if necessary.

Receiving the RNG-REQ with continue status, the MR-BS transmits a RNG-RSP to the RS with the RS basic CID. The message contains adjustment information, ranging status, code attributes and MS ranging indicator.

On the other hand, when the MR-BS receives the RNG-REQ with success status, it sends to the RS a RS UL-MAP including a CDMA_Allocation-IE as well as a RNG-RSP containing MS ranging indicator and status.

The RS receiving the RNG-RSP including MS ranging indicator relays the message with the initial ranging CID after removing the MS ranging indicator.

When the MS receives success status in the RNG-RSP, it sends a RNG-REQ message using uplink bandwidth allocated by CDMA_Allocation-IE.

Receiving the RNG-REQ with the initial ranging CID, the RS relay it to the MR-BS with the RS basic CID.

Once the MR-BS receives the RNG-REQ containing MSID with the RS basic CID, the MR-BS shall assign Basic and Primary management CIDs to the MS, and transmit a RNG-RSP containing those management CIDs and MSID with the RS basic CID.
The RS receiving the RNG-RSP containing the management CIDs and MSID relays it to the MS with the initial ranging CID. After assigning the basic and primary management CID to a MS, the MS and MR-BS continue network entry process as described in 6.3.9.7 through 6.3.9.13 using MS’s management CIDs. The RS shall relay management messages between them. The RS may monitor management messages and derive some information, such as capability information.

The message sequences chart (Table xxx) and flow charts (Figure xxx, Figure xxx, and Figure xxx) on the following pages define the ranging and adjustment process that shall be followed by compliant RSs and MR-BSs. For CDMA ranging process between RS and MS, these details can be found in 6.3.10.3.
**Table xxxx Ranging and automatic adjustments procedure in MR mode**

<table>
<thead>
<tr>
<th>Event</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MR-BS</strong></td>
<td><strong>RS</strong></td>
</tr>
<tr>
<td>[Time to send the initial ranging opportunity in RS access link]</td>
<td>send map containing Initial Ranging IE with RS basic CID</td>
</tr>
<tr>
<td>[Receive Ranging Code]</td>
<td>CDMA Ranging Code</td>
</tr>
<tr>
<td>RNG-REQ</td>
<td></td>
</tr>
<tr>
<td>[Receive RNG-RSP]</td>
<td></td>
</tr>
<tr>
<td>send RNG-RSP containing adjustment information, status, ranging code attributes and MS ranging indicator with RS basic CID. Status = Continue</td>
<td>[Receive RNG-REQ]</td>
</tr>
<tr>
<td>RS UL-MAP</td>
<td>RNG-REQ</td>
</tr>
<tr>
<td>forward the received RNG-RSP containing adjustment information, status, ranging code attributes with initial ranging CID. Status = Continue</td>
<td>RNG-RSP</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>[Time to send the initial ranging opportunity in RS access link]</td>
<td>send map containing Initial Ranging IE with RS basic CID</td>
</tr>
<tr>
<td>[Receive Ranging Code]</td>
<td>CDMA Ranging Code</td>
</tr>
<tr>
<td>RNG-REQ</td>
<td></td>
</tr>
<tr>
<td>[Receive RNG-RSP]</td>
<td></td>
</tr>
<tr>
<td>send RNG-RSP containing status, ranging code attributes and MS ranging indicator with RS basic CID. Status = Success</td>
<td>[Receive RNG-RSP]</td>
</tr>
<tr>
<td>RNG-RSP</td>
<td>RNG-RSP</td>
</tr>
</tbody>
</table>


Table xxxx Ranging and automatic adjustments procedure in MR mode *(continued)*

<table>
<thead>
<tr>
<th>MR-BS</th>
<th>RS</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>send RS UL-MAP containing CDMA_Allocation-IE with RS basic CID.</td>
<td>relay the received MAP with broadcast CID</td>
<td>Transmit RNG-REQ containing MSID and continue with regular Initial network entry</td>
</tr>
<tr>
<td>[Receive RNG-REQ] Identify MS and its connecting RS. Send RNG-RSP containing management CIDs with RS basic CID.</td>
<td>[Receive RNG-REQ] forwards the RNG-REQ to BS with RS Basic CID</td>
<td>[Receive RNG-RSP] forward the RNG-RSP to MS with IR CID</td>
</tr>
<tr>
<td>[Receive RNG-RSP]</td>
<td></td>
<td>Receive RNG-RSP message with matching MSID.</td>
</tr>
</tbody>
</table>

**Figure-xxx MS CDMA ranging - RS**
Wait for RNG-RSP

T3 Timeout

Increment Ranging Retries

Yes

Ranging Retries Exhausted?

Send RNG-RSP to MS (Abort)

Done

Send RNG-REQ to MR-BS (MS ranging)

Send RNG-RSP to MS (Abort)

Wait for RNG-RSP

No

Yes

RNG-RSP

MS ranging flag?

Yes

Status?

Send RNG-REQ to MR-BS (MS ranging)

Start T3

Wait for RNG-REQ

No

Send RNG-RSP to MS (Abort)

Send RNG-RSP to MS (Success)

Send RNG-REQ to MR-BS (MSID)

Send Anonymous BW Allocation

Done

Send RNG-RSP to MS (MSID)

Send RNG-REQ to MR-BS (MS ranging)

RS Ranging Process

MSID?

Yes

Figure-xxx MS initial ranging - RS
6.3.9.16.2.2 Non-transparent RS with Distributed scheduling

In MS network entry procedures to non-transparent RS systems, MS scans for downlink channel and establish synchronization with the non-transparent RS, then obtains transmit parameters from UCD message as described in 6.3.9.1 through 6.3.9.4.

The initial ranging process shall begin by sending an initial-ranging CDMA codes on the UL allocation dedicated for that purpose (for more details see 6.3.10.3). RS and MS continue CDMA code transmission and reception as defined in 6.3.10.3 until RS receives the CDMA code successfully.

When the RS receives the CDMA code resulting in success status, it sends a RNG-REQ message containing New MS Indication ID TLV with the RS’s basic CID to the MR-BS. Up on receiving the RNG-REQ containing New MS Indication ID TLV, the MR-BS confirms whether it can accept a new MS entry request. If it can accept the request, it sends a RNG-RSP containing success status to the RS, otherwise a RNG-RSP with abort status.

When the RS receives the RNG-RSP with ranging status from the MR-BS, it advertises a RNG-RSP containing the same ranging status as in the received RNG-RSP and the ranging code attributes with initial ranging CID. If the ranging status in the RNG-RSP is success, the RS provides bandwidth allocation with CDMA_Allocation-IE in UL-MAP, so that the MS can send a RNG-REQ containing MSID with initial ranging CID.

Receiving the RNG-REQ containing the MSID, the RS forwards it with the RS basic management CID to MR-BS. The RNG-REQ message may contain New MS Indication ID. The RS shall use the same value of New MS Indication ID as in the previous RNG-REQ transmitted upon successful reception of CDMA ranging code, so that the MR-BS can recognize the two RNG-REQ messages containing the same New MS Indication ID are used for the same MS network entry process.
Once the MR-BS receives the RNG-REQ containing MSID with the RS basic CID, the MR-BS shall assign Basic and Primary management CIDs to the MS, and transmit a RNG-RSP containing those management CIDs and MSID with the RS basic CID.

The RS receiving the RNG-RSP containing the management CIDs and MSID shall forward it to the MS with the initial ranging CID.

After assigning the basic and primary management CID to a MS, the MS and MR-BS continue network entry process as described in 6.3.9.7 through 6.3.9.13 using MS’s management CIDs. The RS shall relay management messages between them. The RS may monitor management messages and derive some information, e.g. capability information, etc.

The message sequences chart (Table xxx) and flow charts (Figure xxx, Figure xxx, and Figure xxx) on the following pages define the ranging and adjustment process that shall be followed by compliant RSs and MR-BSs. For CDMA ranging process between RS and MS, these details can be found in 6.3.10.3.
Table xxx Ranging and automatic adjustments procedure in MR mode

<table>
<thead>
<tr>
<th>MR-BS</th>
<th>RS</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Time to send the initial ranging opportunity]</td>
<td>send map containing Initial Ranging IE with a broadcast Connection ID</td>
<td>UL-MAP</td>
</tr>
<tr>
<td>[Receive Ranging Code]</td>
<td>Send RNG-RSP with Time &amp; Power Corrections and original Ranging Code and Ranging Slot</td>
<td>CDMA Ranging Code</td>
</tr>
<tr>
<td>Status = Continue</td>
<td>RNG-RSP</td>
<td>Receive RNG-RSP message with Ranging Code and Ranging Slot matching sent values. Adjust Time &amp; Power parameters</td>
</tr>
<tr>
<td>[Time to send the initial ranging opportunity]</td>
<td>send map containing Initial Ranging IE with a broadcast Connection ID</td>
<td>UL-MAP</td>
</tr>
<tr>
<td>[Receive Ranging Code]</td>
<td>Status = Success</td>
<td>CDMA Ranging Code</td>
</tr>
</tbody>
</table>

| [Receive RNG-REQ] |send RNG-REQ containing New MS Indicator with RS Basic ID | RNG-REQ |
| [Receive RNG-RSP] | If status is success in RNG-RSP, send RNG-RSP containing success status with IR CID. | RNG-RSP |
| send UL-MAP containing CDMA_Allocation-IE. | UL-MAP |
| [Receive RNG-REQ] | If RNG-REQ has IR CID and MSID, then RS forwards it to BS with RS Basic CID | RNG-REQ |
| Identify MS and its connecting RS. Send RNG-RSP containing management CIDs with RS basic CID. | RNG-RSP |
| [Receive RNG-RSP] | forward the RNG-RSP to MS with IR CID | RNG-RSP |
| Receive RNG-RSP message with matching MSID. | | |
Wait for Initial Ranging Code

Initial Ranging Code

No

Send RNG-RSP (Continue or Abort)

Done

Good Enough?

Yes

Send RNG-REQ to MR-BS (New MS Ind.)

Start T3

Wait for RNG-RSP

Figure-xxx MS CDMA ranging - RS
Wait for RNG-RSP

T3 Timeout

RNG-RSP

Increment Ranging Retries

Yes

No

Ranging Retries Exhausted?

Send RNG-RSP to MS (Abort)

Send RNG-REQ to MR-BS (New MS Ind.)

Send RNG-RSP to MS (Abort)

Send RNG-RSP to MS (Success)

Send RNG-RSP to MS (MSID)

RS Ranging Process

Status?

Success

Send Anonymous BW Allocation

Done

Wait for RNG-RSP

Send RNG-RSP to MS (MSID)

Wait for RNG-REQ

RNG-REQ (MSID)

Good Enough?

Yes

Send RNG-RSP to MS (Continue/Abort)

Start T3

Wait for RNG-REQ

No

Send RNG-REQ to MR-BS (MSID)

Done

Figure-xxx MS initial ranging - RS
Figure-xxx MS initial ranging – MR-BS

Insert the following rows into Table 364 at 11.5 RNG-REQ TLV:

<table>
<thead>
<tr>
<th>Name</th>
<th>Type (1 byte)</th>
<th>Length</th>
<th>Value (variable-length)</th>
<th>PHY Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>New MS Indication ID</td>
<td>TBA</td>
<td>1</td>
<td>Unique identifier assigned by RS for each MS under ranging process.</td>
<td>OFDMA</td>
</tr>
<tr>
<td>MS ranging Indicator</td>
<td>TBA</td>
<td>1</td>
<td>0: reserved 1: indicates this message used for MS ranging 2-255: reserved</td>
<td>OFDMA</td>
</tr>
<tr>
<td>Timing Adjust</td>
<td>TBA</td>
<td>4</td>
<td>Tx timing offset adjustment (signed 32-bit). The amount of time required to adjust SS transmission so the bursts will arrive at the expected time instance at the BS. Units are PHY specific (see 10.3).</td>
<td>OFDMA</td>
</tr>
<tr>
<td>Power Level Adjust</td>
<td>TBA</td>
<td>1</td>
<td>Tx Power offset adjustment (signed 8-bit, 0.25 dB units) Specifies the relative change in transmission power level that the SS is to make in order that transmissions arrive at the BS at the desired power. When subchannelization is employed, the</td>
<td>OFDMA</td>
</tr>
</tbody>
</table>
subscriber shall interpret the power offset adjustment as a required change to the transmitted power density.

<table>
<thead>
<tr>
<th>Offset Frequency Adjust</th>
<th>Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TBA</td>
<td>4</td>
<td>Tx frequency offset adjustment (signed 32-bit, Hz units) Specifies the relative change in transmission frequency that the SS is to make in order to better match the BS. (This is fine-frequency adjustment within a channel, not reassignment to a different channel.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ranging Status</th>
<th>Type</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TBA</td>
<td>1</td>
<td>Used to indicate whether uplink messages are received within acceptable limits by BS. 1 = continue, 2 = abort, 3 = success</td>
</tr>
</tbody>
</table>

Insert the following rows into Table 367 at 11.6 RNG-RSP TLV:

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Length</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>New MS Indication ID</td>
<td>TBA</td>
<td>1</td>
<td>New MS Indication ID from corresponding RNG-REQ froMRS.</td>
</tr>
<tr>
<td>MS ranging Indicator</td>
<td>TBA</td>
<td>1</td>
<td>0: reserved 1: indicates this message used for MS ranging 2-255: reserved</td>
</tr>
</tbody>
</table>

References
