Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**MS / RS network entry and initialization**
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Re:	This document is the reply of the call for contribution IEEEP802.16j
Abstract	This mechanism, process and procedures of MS/RS entry and initialization are defined in this document.
Purpose	This document is provided as the input for the IEEE802.16j.
Notice	
Release	
Patent Policy and Procedures	

MS / RS network entry and initialization

1 Introduction

This document is to describe RS and MS network entry procedure as an input for call for contribution of 802.16j task group. RS network entry procedure is a mandatory technical requirements defined in IEEE C802.16j-06_017 contribution [1]. As required in the reference documents, system should support the applicable procedures for entering and registering a new MS through RS, or entering and registering a new RS directly or through other RSs. To make the changes as few as possible, RS network entry procedure shall be better to be based on that of MS, except that distinguished RS capability. In this document, we propose the messages, a set of procedures to support the complemented RS network entry procedure in relay network.

2 Proposed scheme

In the relay network, MS shall follow the legacy network entry and initialization process for the backward compatibility. However, RS is involve in this process via relaying the messages, and does in also access station selection and topology decision process. In MS initialization procedure, MS may be located in the common area covered by several RSs or MR-BS. MR-BS decides appropriate access basestation for the MS based on some criteria. In other words, MR-BS should decide whether RS or which RS is attached by the MS.

On the other hand, for new-entry RS, its network entry procedure is different. At first, RS should identify itself as a RS role to MR-BS in a manner. After this, MR-BS starts a new entry procedure for RS.

2.1 MS network entry and initialization process in relay network

The procedure for MS initialization in relay mode is shown in Figure 1. As for the downlink channel scanning and synchronization, the process is exactly the same as the conventional one. MR-BS broadcasts synchronization and MAP information, and MS synchronizes to the downlink channel for downlink and uplink parameters. However, ranging procedure performed by MS is a little bit different from the current procedure, especially if MS is located within the coverage of RS and far away from MR-BS, the ranging procedure requires RS involvement. Here assumed that MR-BS and RS allocate a common initial ranging channel to accept MS or BS initial ranging request.

2.1.1 MS Initial ranging

MS shall synchronize to the downlink and know the uplink channel parameters through the UCD MAC management message sent by MR-BS. On the other hand, MS scans UL-MAP to find out where is the initial ranging channel. Then, MS sends CDMA initial ranging signal sharing with other MS or BS. It is possible that BS or multiple RSs can receive the CDMA initial ranging request.

2.1.2 RS measurement and report

In this stage, RS keeps monitoring CDMA ranging requests sent by MSs. RS detect possible CDMA codes used by MS from the received CDMA initial ranging signals, and then report detected CDMA codes, estimated time offset, signal power etc. for each detected CDMA code using MMR-RNG_REP message. The report messages are forwarded by upstream RSs one by one straight to MR-BS.
All RS detecting MS CDMA initial ranging signal shall send MMR-RNG_REP message.

2.1.3 Path selection

Thus MR-BS may receive two or more initial ranging report messages in a specified interval in unit of frame. An example is illustrated in Figure 1. One ranging request RNG_REQ is directly detected by MR-BS, and the other is MMR-RNG_REP message reported by downstream RS. MR-BS knows that the two messages specify the same MS since they have the same CDMA code.
MR-BS measures and compares these two ranging messages, and decides if relaying is necessary for the specified MS. Here the selection algorithm is vendor-specific. For example, If the signal quality of direct MS-MR-BS access link is good enough, MS will attach to BS directly. MR-BS just returns RNG-RSP message without considering RS existence. All following procedures are the same as the conventional ones also defined in the standard.

However, if the direct MS-MR-BS link is of bad quality, signal quality of MS-RS is relatively good for high data throughput, relaying is required for throughput enhancement. What's more, in some extreme cases the access link budget for MS-MR-BS link is too weak

for MR-BS to detect the direct ranging request from MS. Only ranging report sent by RS can be received by MR-BS. As a result, MR-BS requires to introduce RS in the path between MS and MR-BS.

In order to support relaying, MR-BS returns RNG-RSP message through RS using the initial ranging CID until a RNG-RSP message with success status is sent. Here the RF power level adjustment contained in the RNG-RSP message comes from signal level measurement by RS. Because the all uplink transmission from these MSs shall be firstly received by RS and relayed to MR-BS, so the MS's power level shall be adjusted to accommodate to MS-RS transmission link. The same adjustment dose for timing offset corrections to MS. From the viewpoint of MS, it takes RS as a MR-BS and all uplink communication occur with this faked MR-BS.

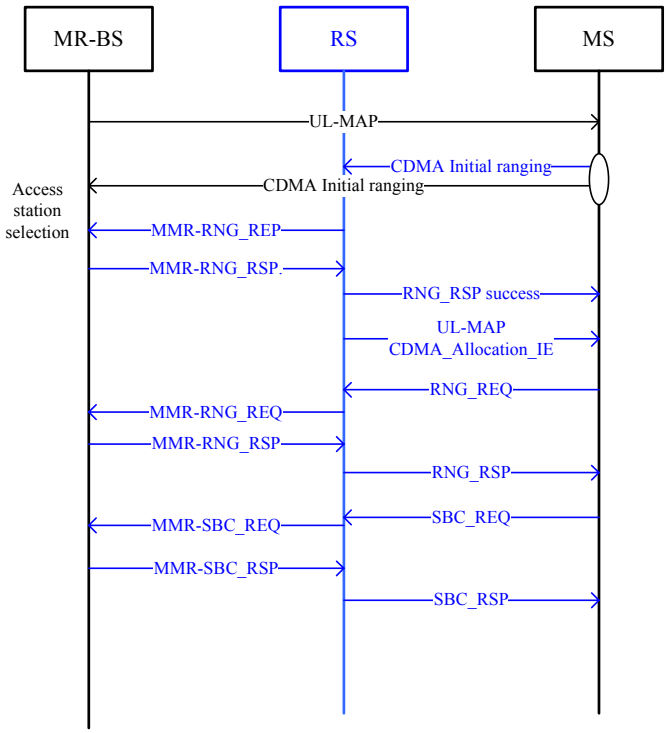

Figure 1 MS network entry and initialization in relay mode

2.2 RS network entry and initialization procedure

RS network entry an initialization process is the same as MS except that RS identify itself as a relay station in the network entry procedure. This RS identification information can be transmitted using new-defined CDMA code dedicated for RS(option 1), modified RS RNG_REQ message (option 2) or modified RS SBC_REQ (option 3)message, or other new kind of MAC message. One common ranging channel is shared by MR-BS and RS. After completing network entry and initialization procedure, RS monitors and measures link quality in MS initial ranging procedure through this common initial ranging channel. MR-BS maintains the status and quality of relay links between RSs or RS and MR-BS, and the status information is updated by RS network entry or later. Based on this status information, MR-BS may select an optimal relay path for each RS.

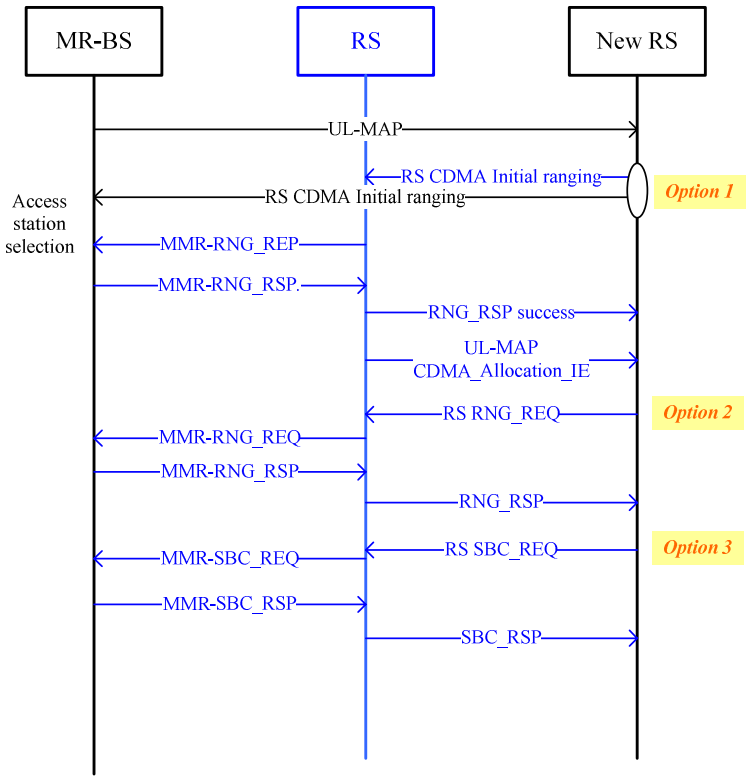

Figure 2 RS network entry procedure

3 Text to be inserted into standard

6.3.2.3 MAC management messages

Change the title of subclause 6.3.2.3.4

6.3.2.3.4 MS/RS RNG_REQ management message

Insert the last paragraph at the end of 6.3.2.3.4.

The following parameters may be included in the RNG_REQ message when RS is attempting to perform network entry or handover and RS needs to inform upstream RSs and MR-BS that it is a RS.

Relaying capability Indicator
Indicates the RS is currently attempting to perform network entry and handover.

Change the title of subclause 6.3.2.3.23

6.3.2.3.23 SS/RS basic capability response (SBC-RSP) message

Insert the last paragraph at the end of 6.3.2.3.23

Relay capabilities parameters (see 11.8.9)

Relaying capability Indicator
Indicates the station has relaying capability

Inserts a new subclause 6.3.2.3.63

6.3.2.3.63 RS MMR-RNG_REQ management message

Insert new TLVs into Table 369.

Syntax	Size	Notes
MMR-RNG_REQ (){	—	—
Management message type = xx	8 bits	—
N_Ranging_Request		
for (i=0; i<= N_Ranging_Request, i++) {		
Specific encoded TLV	*Variable*	
}		
}	—	—

Inserts a new subclause 6.3.2.3.64

6.3.2.3.64 RS MMR-RNG_RSP management message

Once RS receive the MMR-RNG_RSP messages from upstream RS or MR-BS, RS shall generate RNG_RSP to MS according to the parameters included in MMR-RNG_RSP message.

Syntax	Size	Notes
MMR-RNG_RSP (){	—	—
Management message type = xx	8 bits	—
N_IR_CDMA_code	8 bits	Number of Initial ranging CDMA code
for (i=1; i<= N_IR_CDMA_code; i++){		
OFDMA specific encoded TLVs		Specific parameters for each CDMA code (see 11.6)
}		
}	—	—

Inserts a new subclause 6.3.2.3.65

6.3.2.3.65 RS MMR-RNG_REP management message

Syntax	Size	Notes
MMR-RNG_REP (){	—	—
Management message type = xx	8 bits	—
N_IR_CDMA_code	8 bits	Number of Initial ranging CDMA code
for (i=1; i<= N_IR_CDMA_code; i++){		
OFDMA specific encoded TLVs		Specific parameters for each CDMA code (see 11.6)

}		
}	—	—

Inserts a new subclause 11.8.9

11.8.9 Relaying support

The *Relaying support* field indicates if the station has relaying capability and type of relay station.

Type	Length	Value	Scope
168	1	*Bit #0: Relaying capability* *Bit #1: No relaying capability* *Bit #2-7: Reserved; shall be set to zero*	SBC-REQ(see 6.3.2.3.23)

References

[1] IEEE 802.16j-06_016r1, "Proposed Technical Requirements Guideline for IEEE 802.16 Relay TG"
[2] IEEE 802.16j-06_017r2, "Table of Contents of Task Group Working Document"
[3] IEEE C80216mmr-05_023, "Recommendation on 802.16 MMR with Backward Compatibility"
[4] IEEE C802.16j-06/004r1, "Recommendations on IEEE 802.16j"