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| Project | IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**> |
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| Re: | IEEE 802.16j-07/013: “Call for Technical Comments Regarding IEEE Project 802.16j” |
| Abstract | This contribution proposes RS Initial Ranging for Network Entry |
| Purpose | Adopt the text proposal in this document |
| Notice |  |
| Release |  |
| Patent Policy and Procedures |  |

# RS Initial Ranging for Network Entry

## Introduction

The purpose of this document is to define an optional RS CDMA initial ranging code set in order to speed up the convergence of RS network entry.

Contribution C802.16j-07_311 proposes RS network entry process with optional path selection stages for controlling the topology of MR network during network entry. However, if the path selection stage is omitted during RS network entry, the RS might go into "network entry loop", which is described below.

1. RS starts RS network entry by scanning for downlink channel
2. RS establishes downlink synchronization
3. RS performs initial ranging with random IR code
4. RS follows MS network entry procedures
5. RS is identified as 16j relay at SBC message exchanges stage
6. RS is configured by MR-BS
7. RS go into operational state
8. The hop count limit is exceeded, DREG is sent to RS
9. RS go to 1

Since the MR-BS cannot identify the RS due to the fact that the RS acquires another random IR code, the loop between 1 to 9 will be repeated. Therefore, we propose that the RS may use distinct RS initial ranging code set for RS network entry to resolve above problem, such that MR-BS is able to identify the RS and perform initial topology control at the earliest stage.

Even though the optional path selection stages are performed in the RS network entry either before "RS operation parameter configuration" procedure or before "obtain uplink parameters" procedure, the proposed RS initial ranging code and associated schemes could still be supplemental to speed up the convergence of the RS network entry processes.

Additional benefits of RS initial ranging code set are listed below.

1. In RS network entry within a Virtual Group, the initial ranging code is always forwarded by all RS, which successfully decode the IR, to MR-BS via the RNG-REQ message. A distinct initial ranging code that identifies an RS could dramatically cut down the RNG-REQ messages overheads for relay paths and MR-BS processing, because the RS that has reached the hop count limit won't response the RS IR code received.

2. When RS and MS are sharing the same ranging code sets, RS and MS cannot be differentiated by MR-BS until the capability negotiation phase during network entry. That is, RS needs separate ranging code sets to avoid collisions with MS and potentially get highest priority when competing with other MS during network entry process.

## Proposed Remedy

Optional RS Initial ranging codes set, illustrated in Figure 1, is defined for RS initial ranging functionalities. MR-BS should be able to differentiate RS and MS by ranging codes. In order to avoid RS network entry loop due to try and error approaches, MR-BS may abort a RS initial ranging process by sending a RNG-RSP containing status = 2 (abort) with preamble indexes of candidate neighbor access stations. Upon receiving RNG-RSP containing status abort with preamble indexes, RS shall scan for DL channel of candidate neighbor access stations and perform initial ranging again.

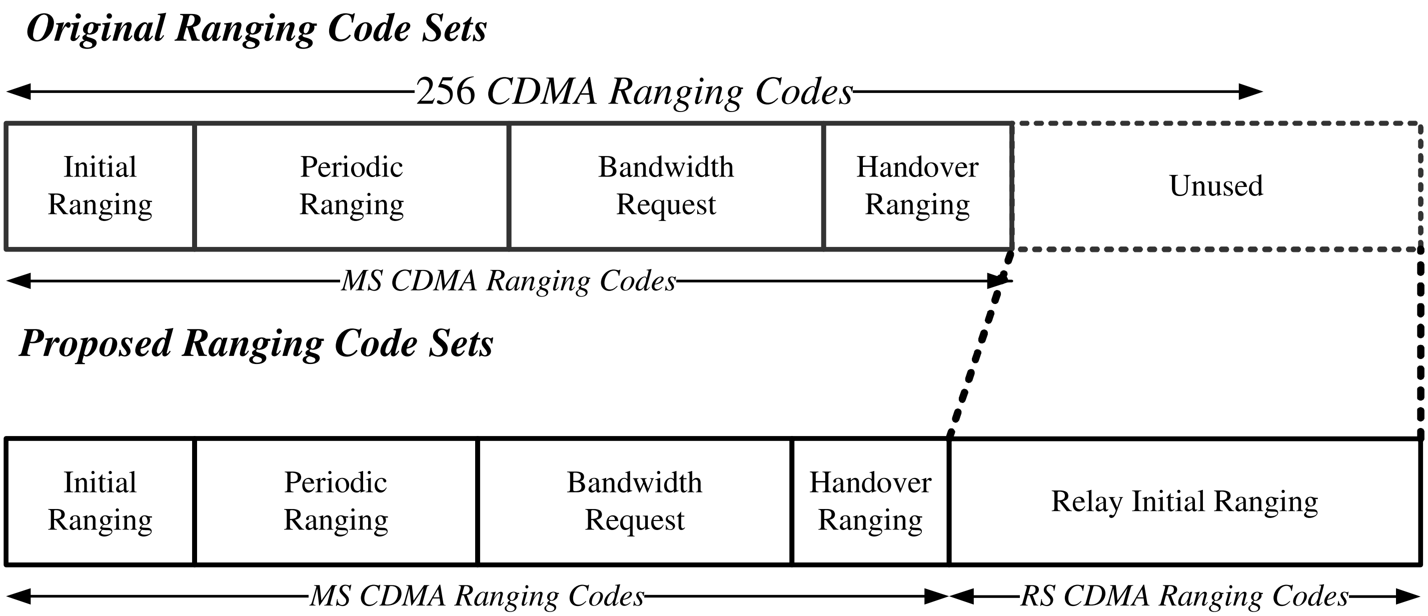


Figure 1 Comparison between Original and Proposed Ranging Code Sets

## Advantages of Using Distinct RS Ranging Code Sets

1. Advantages of Using RS Initial Ranging Code Sets

   A. *MR-BS can differentiate RS from MS in the initial ranging phase of network entry*

   B. *MR network topology establishment can be achieved before using routing protocol when RS uses distinct ranging code set from the MS*

      ✓ *MR-BS could configure one RS to be the endpoint of a RS path by setting the RS to ignore any request with RS initial ranging code*

      ✓ *MR-BS could apply alternative topology control policy to RS initial ranging code*

   C. *RS IR could be almost collision-free for fixed & nomadic RS*

Figure 2 illustrates an example of advantages by using RS Initial Ranging Code for a 2-hops MR system (hop count limit =2). RS3 cannot join the MR network via RS1 due to policy restrictions (i.e. hot count limit). There are two possible ways for RS3 joining the MR network shown in Figure 2. RS3 could ramp up its transmission power of initial ranging until MR-BS can decode the initial ranging message correctly, and alternatively RS1 could forward the initial ranging message to MR-BS and MR-BS tells RS3 how to adjust radio parameters such that the RS3 can do initial ranging with MR-BS directly.

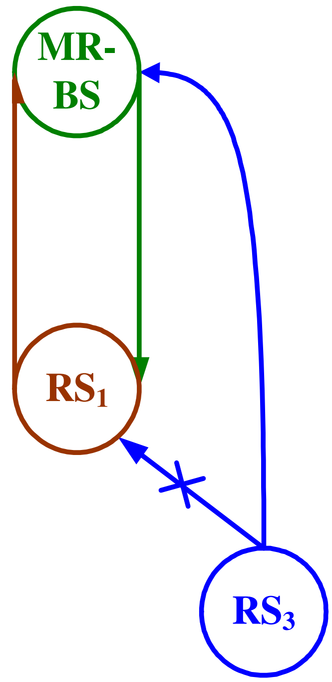


Figure 2 RS cannot join a 2-hop MR network via RS

We propose to define distinct code sets for RS and MS, respectively. In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026r3 are listed below.

## Text Proposal

6.3.10.3 OFDMA-based ranging

*[Insert the following subclause in 6.3.10.3 in page 66:]*

6.3.10.3.1 Contention-based initial ranging and automatic adjustments

*[Insert the following text at the end of subclause 6.3.10.3.1:]*

The RS initial ranging procedure shall follow the same procedure of the MS. Upon receiving UCD message containing RS_Initial_Ranging_Code TLV, the RS should use "RS Initial Ranging" code instead of the "Initial Ranging" code.

After receiving RS Initial Ranging code, MR-BS may send a RNG-RSP containing status = 2 (abort) with preamble indexes of candidate neighbor access stations. Upon receiving RNG-RSP containing status abort with preamble indexes, RS shall scan for DL channel of candidate neighbor access stations and perform initial ranging.

*[Insert the following subclause in section 8.4.7 in page 108:]*

8.4.7.3 Ranging codes

*[Change the fourth paragraph as indicated:]*

The number of available codes is 256, numbered 0..255. Each BS uses a subgroup of these codes, where the subgroup is defined by a number $S$, 0 <= $S$ <= 255. The group of codes will be between S and (($S$+$O$+$N$+$M$+$L$+$P$) mod 256).

— The first $N$ codes produced are for initial-ranging. Clock the PRBS generator $144 \times (S \bmod 256)$ times to $144 \times ((S + N) \bmod 256) - 1$ times.

— The next $M$ codes produced are for periodic-ranging. Clock the PRBS generator $144 \times ((N + S) \bmod 256)$ times to $144 \times ((N + M + S) \bmod 256) - 1$ times.

— The next $L$ codes produced are for bandwidth-requests. Clock the PRBS generator $144 \times ((N + M + S) \bmod 256)$ times to $144 \times ((N + M + L + S) \bmod 256) - 1$ times.

— The next $O$ codes produced are for handover-ranging. Clock the PRBS generator $144 \times ((N + M + L + S) \bmod 256)$ times to $144 \times ((N + M + L + O + S) \bmod 256) - 1$ times.

— The next $P$ codes produced are for RS initial-ranging. Clock the PRBS generator $144 \times ((N + M + L + O + S) \bmod 256)$ times to $144 \times ((P + N + M + L + O + S) \bmod 256) - 1$ times

*[Insert the following subclause in chapter 11 in page 113:]*

11.3 UCD management message encodings

11.3.1 UCD channel encodings

*[Change Table 353 as indicated:]*

Table 353—UCD PHY-specific channel encodings—WirelessMAN-OFDMA

| Name | Type (1 byte) | Length | Value (Variable-length) |
|---|---|---|---|
| RS Initial Ranging Code | TBA | 1 | Number of handover ranging CDMA codes. Possible values are 0-255. |

11.6 RNG-RSP message encodings

*[Change Table 367 in page 114 as indicated:]*

Table 367—RNG-RSP message encodings

| Name | Type (1 byte) | Length | Value (Variable-length) |
|---|---|---|---|
| Preamble Indexs | TBA | Number of candidate neighbor access stations | 8 bit index of preamble indexes of candidate neighbor access stations |