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Proposal for Fast Timing Synchronization in OFDMA

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1. Introduction

In order to perform a handover, an MSS shall scan a Neighbor BS to obtain its synchronization and CINR. For adopting OFDMA specified in the current 802.16 standard, an MSS can synchronize by using preamble allocated to a single symbol in each frame. The acquisition of preamble is a very essential and important process because the flow of most signals between BS and SS starts after timing synchronization.

However, since MSS has only a single chance in each frame to acquire a preamble, timing synchronization can be done only in frames; i.e., it may take several frames for an MSS to get timing synchronization based on preambles. If the MSS miss a preamble, it should wait for the next frame. Additionally, if there are several BSs that an MSS needs to synchronize with, it should repeat the procedures for synchronization per each BS, which makes the MSS waste power and degrades communication quality due to delay during a handover to neighbor BS.

2. Proposed Remedy

Therefore, we propose new and simple reference signals to reduce the time for synchronization. Because the proposed reference signals enable an MSS to obtain synchronization in not only frames but also symbols, the MSS can obtain synchronization in an easy way. Also, the proposed signals do not affect the existing structure of OFDMA system specified in IEEE 802.16 standard.

We consider using some guard bands as new reference signals. Unlike preamble, new reference signals may be spread in every DL subframe. They are allocated to the reserved subcarriers and mapped onto the symbols in ascending order. If an MSS decodes reference signals of the symbol, an MSS can decide what a symbol's sequence is out of a frame. It may repeat the procedures till it has a correct synchronization.

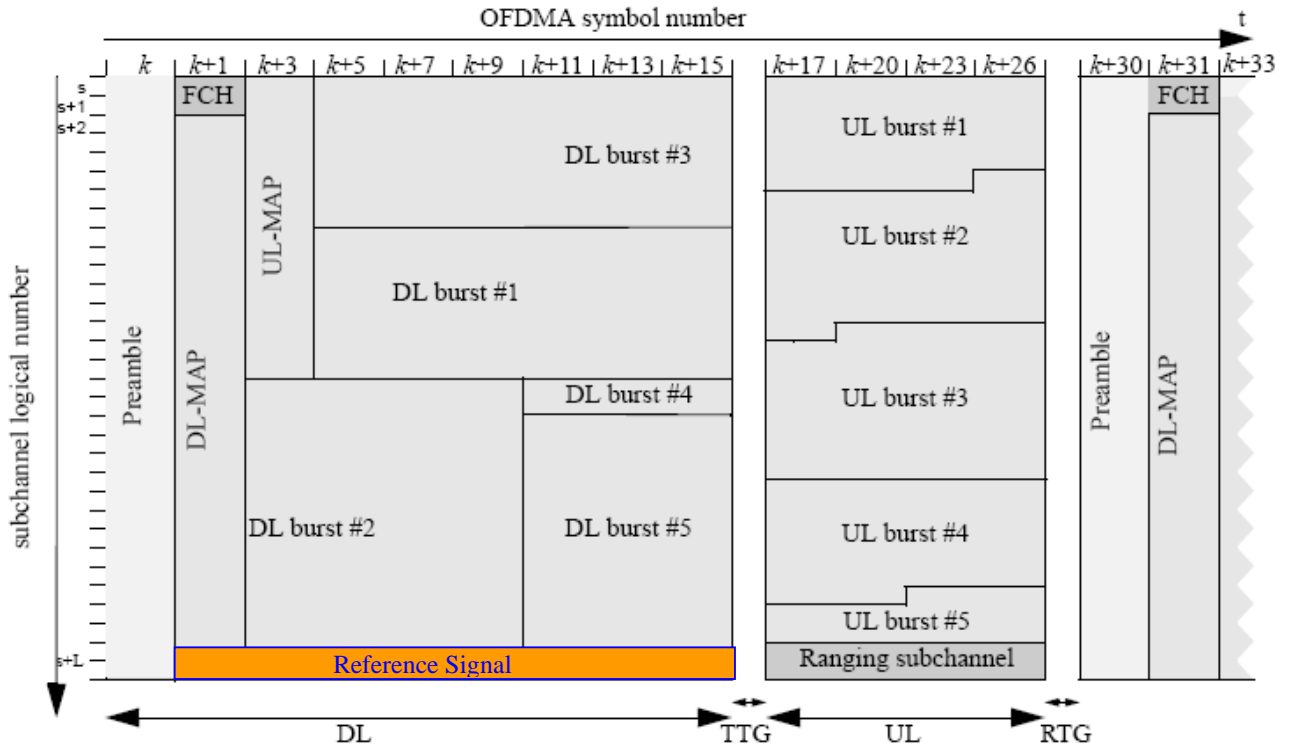


Figure 1. Example for reference signals allocation in OFDMA

Remedy 1 :

[Add a new section 8.4.6.1.1.1 Optional reference signals]

8.4.6.1.1.1 Optional reference signals

Reference signals for timing synchronization in symbols are allocated to the reserved subcarriers in downlink subframe. For the case where the bandwidth is 20MHz and frame duration is 5ms, the subcarriers are defined in Table xxx. Of all 2048 subcarriers, there are 36 subcarriers used for reference signals, and it means that they can be divided 6 groups and each group has 6 subcarriers.

The values included in every group are same and modulated using a boosted BPSK modulation. The values represent 6 bits' natural ascending numbering (000000~111111 in binary). An MSS may be informed of the sequence of the symbol out of a frame based on the reference signals of the symbol.

Table xxx – Reference signals allocation

| <u>Parameter</u> | <u>Value</u> | <u>Comments</u> |
|--------------------------|-----------------------|--|
| <u>Reference Signals</u> | <u>36 subcarriers</u> | <u>Allocated Frequency offset indices of subcarriers.</u> <u>Left Guard Band: {141:146, 147:152, 153:158}</u> <u>Right Guard Band: {1890:1895, 1896:1901, 1902:1907}</u> |