Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**OFDMA Frame Structures with Scalable Bandwidth and High-Mobility Support for IEEE 802.16m**
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Re:	IEEE 802.16m-07/040 - Responds to Call for Contributions on Project 802.16m System Description Document (SDD)
Abstract	This contribution proposes new frame structures for IEEE 802.16m with the following salient features: backward compatible to the legacy IEEE 802.16 OFDMA system, support of lager, flexible bandwidth and support of services in high mobility environments.
Purpose	For 802.16m discussion and adoption
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OFDMA Frame Structures with Scalable Bandwidth and High-Mobility Support for IEEE 802.16m

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1. Summary

In this contribution, we discussed frame structures for IEEE 802.16m with scalable badwidth, support of legacy systems and/or working in high-mobility environments. Scalable bandwidth is achieved by aggregating the legacy systems wisely while high-mobilty is supported by introducing new working zone, where new designs should be placed to counteract the adverse effect of high mobility.

Proposed Text

----------*Begin Proposed Text* ----------

X. Frame Structures for IEEE 802.16m

According to IEEE 802.16m SRD, there is a requirement for co-existence with legacy **WirelessMAN-OFDMA Reference System**, the frame structure described in section X.1 can be used. When there is a requirement for high-mobility, the frame structure described in section X.2 can be used.

X.1 Frame structure for legacy support

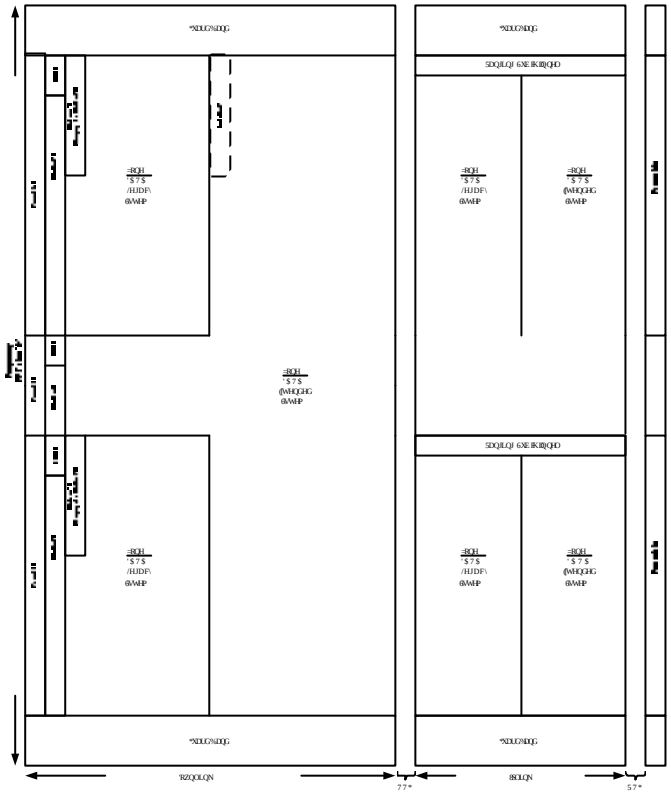

Figure X: Example of extended OFDMA frame structure with a scalable bandwidth

X.2 Frame structure for high mobility and legacy support

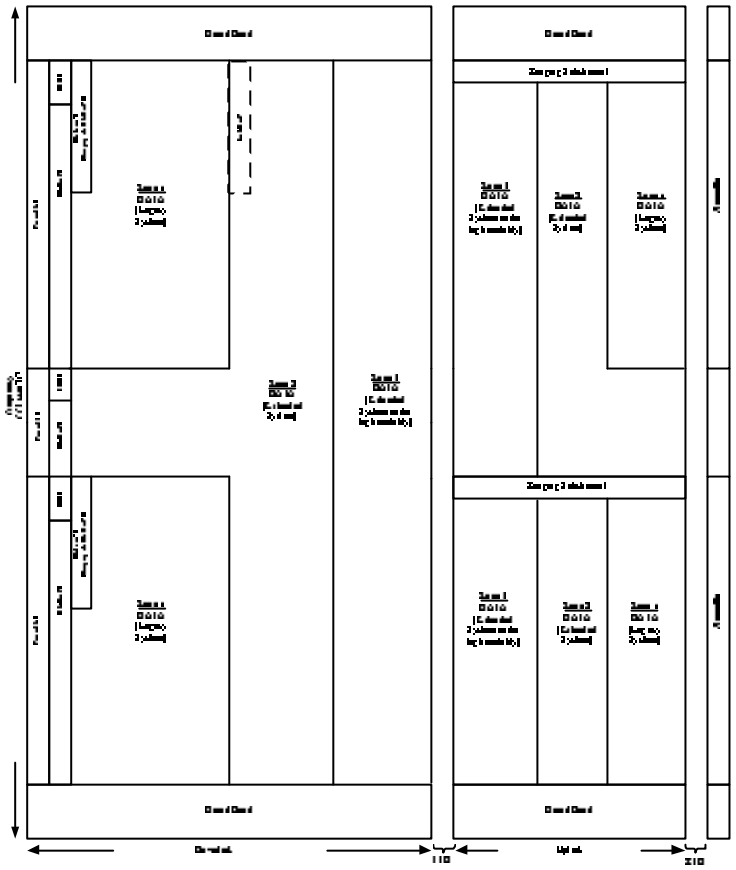

Figure X: Example of extended OFDMA frame structure with a scalable bandwidth for high mobility support

----------***End Proposed Text***----------

2. Introduction

In IEEE 802.16m SRD (system requirement document) [1], it has been agreed that IEEE 802.16m shall support the legacy system with scalable bandwidths from 5 to 20 MHz at high mobility. In response, this contribution proposes two frame structures for IEEE 8-2.16m with the following salient features: backward compatible to the legacy IEEE 802.16 OFDMA system, support of lager, flexible bandwidth and support of services in high mobility environments.

3. Frame structures with legacy support

In this section, frame structures that are backward compatible to the legacy IEEE 802.16 OFDMA system are discussed for IEEE 802.16m with same or lager bandwidth. For reference purpose, Fig. 1 depicts the legacy IEEE 802.16 OFDMA TDD frame structure which constitutes of a DL and an UL sub-frame. The control part includes Preamble, FCH (frame control header), DL-MAP, UL-MAP and ranging sub-channels.

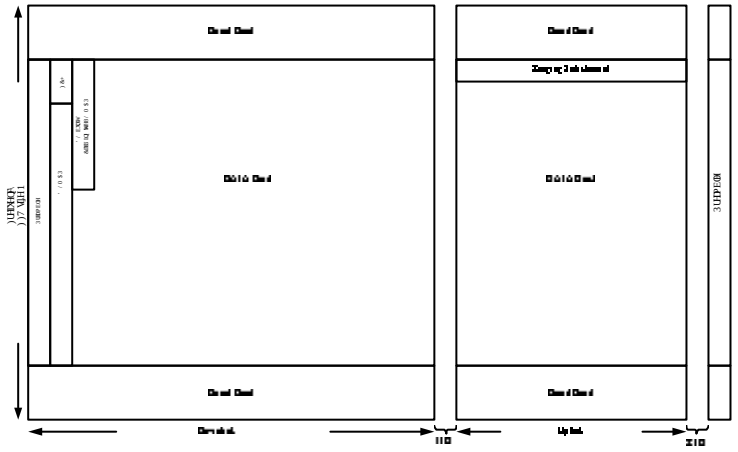

Figure 1 TDD frame structure of legacy IEEE 802.16 OFDMA system

Fig. 2 depicts an example of 16m frame structure that has the same bandwidth as the legacy system, where the frame constitutes the control part and two data-zones. Both the legacy and 16m MSs listen to the control part for system and control messages, The legacy users use Data-zone 1 exclusively for transmitting/receiving data, while 16m users can use both the data regions. The Sub-Map will be used exclusively for the 16m users and is only used when the DL-MAP, UL-MAP are not large enough to accommodate all the users, including the legacy and 16m ones. New technologies may be applied to data-zone where 16m users are using in order to meet the system requirement laid out in IEEE 802.16m SRD.

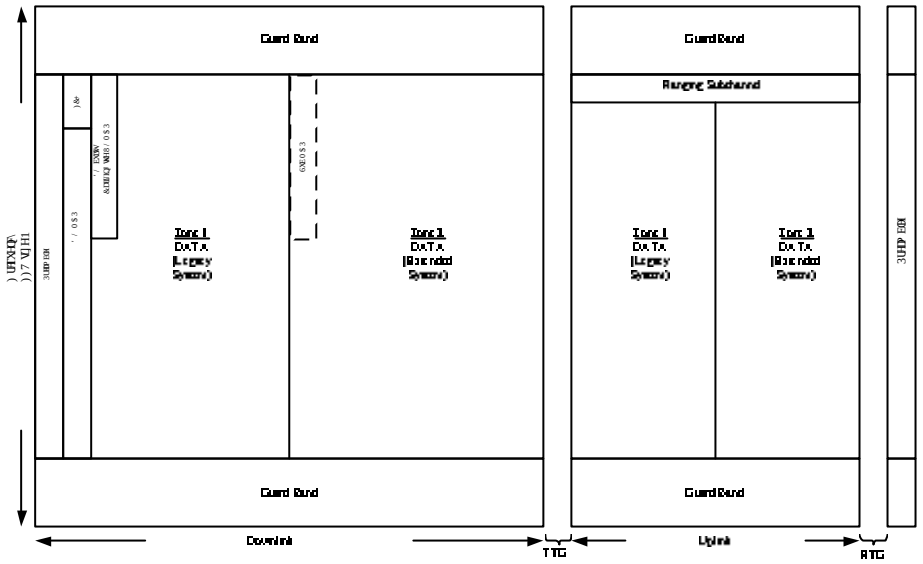

Figure 2 A TDD OFDMA frame structure for IEEE 802.16m with the same bandwidth as the legacy system

Fig. 3 depicts an example OFDMA frame structure for IEEE 802.16m with a scalable bandwidth, where the frame is divided into three zrons: Zone-1, Zone-2 and Zone-3. The legacy users only use Zone-1 and Zone-2 (in blue),while the 16m users can use all of the three zones. In other words, a legacy user listens to the control part of the Zone-1 or Zone-2 for system and control messages, and transmits/receives in the data regions as same as in the legacy system. For the 16m user, however, it has to listen to the control part of all three zones altogether for the system and control messages while transmits/receives data in the data region of any of three zones. Basically, the new OFDMA frame structure is an aggregation of two legacy systems along with a new zone for 16m. The FFT size of the new frame structure is twice that of the legacy system in this example, and the guard band is used exclusively for the 16m system. Again, the Sub-MAP may not be necessary depending on whether the DL-Map and UP-MAP are large enough to accommodate all the users or not. Obviously, the frame structure can be extended easily to more than two legacy systems.

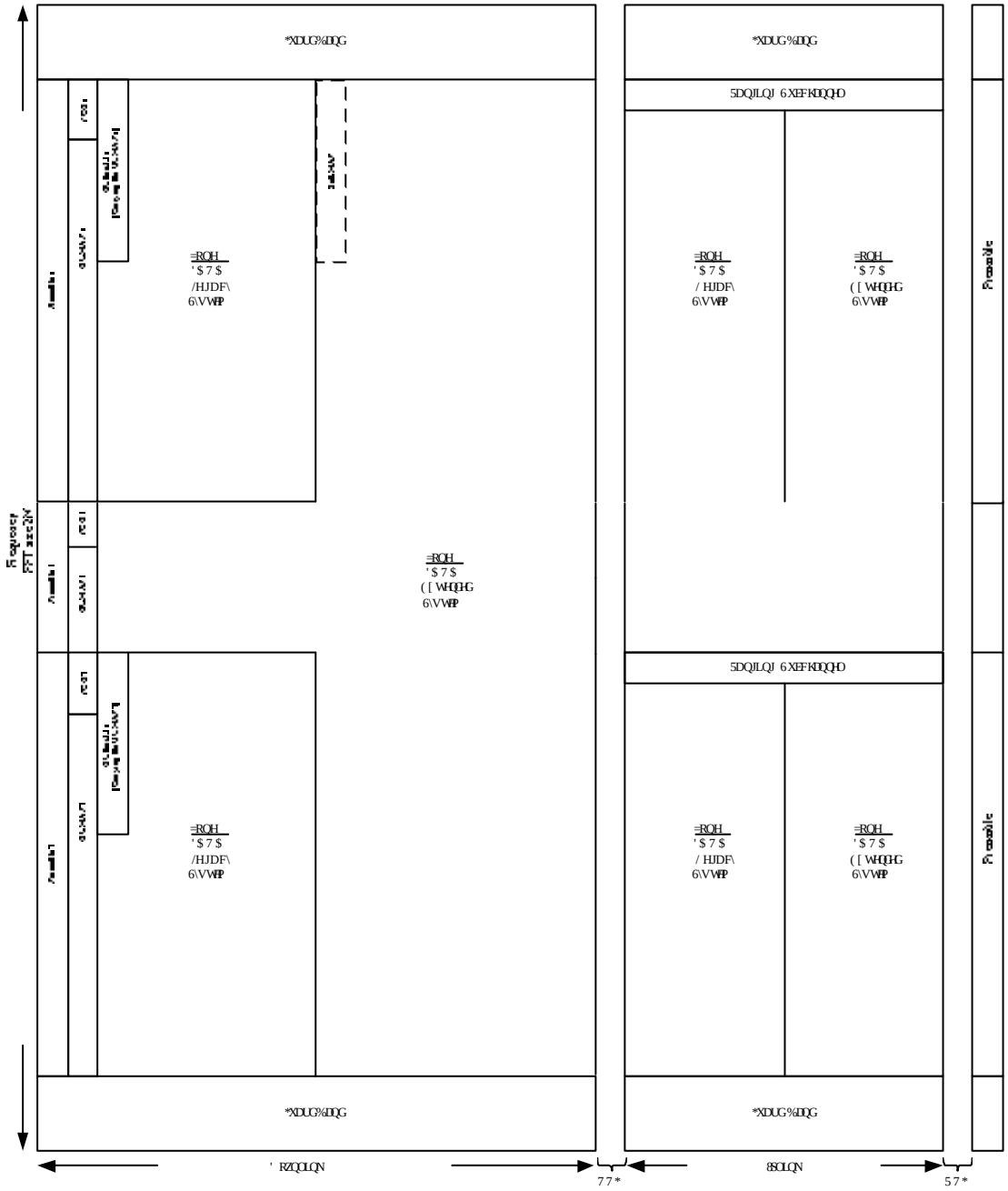

Figure 3 A TDD OFDMA frame structure for IEEE 802.16m with a scalable bandwidth

4. Frame structures for high mobility and legacy support

In this section, frame structures for high mobility environments are discussed for IEEE 802.16m. Fig. 4 is an frame structure for high mobility environments with the same bandwidth as the legacy system. Compared to Fig.

2, a new zone-3 is designed exclusively for high-mobility users. Zone-3 may have new designs for improving performance in high-mobility environments, including using a shorter symbol period (larger carrier spacing, less FFT Size) to mitigate inter-carrier-interference (ICI) due to high mobility , more pilots for enhancing the performance of channel estimation, and/or specific pilots sequence for better ICI cancellation. In addition, a preamble and a Sun-MAP may be needed in zone-3 for working in high-mobility envieronments.

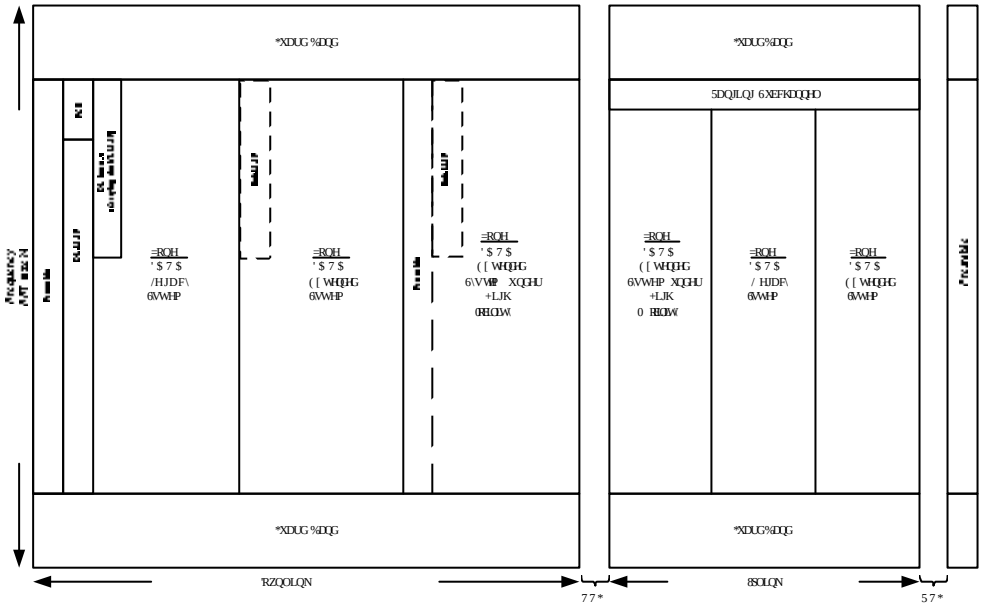

Figure 4 An TDD OFDMA frame structure for IEEE 802.16m in high-mobility environment

Fig. 5 and Fig. 6 show two frame structures for IEEE 802,16m for working in high-mobility environments with scalable bandwidth. The basic idea is quite similar to the one in Fig. 4, where a new zone is introduced for serving high mobility users. The difference between the two is the locations of Zone-1 and Zone-3 in the up-link sub-frame.

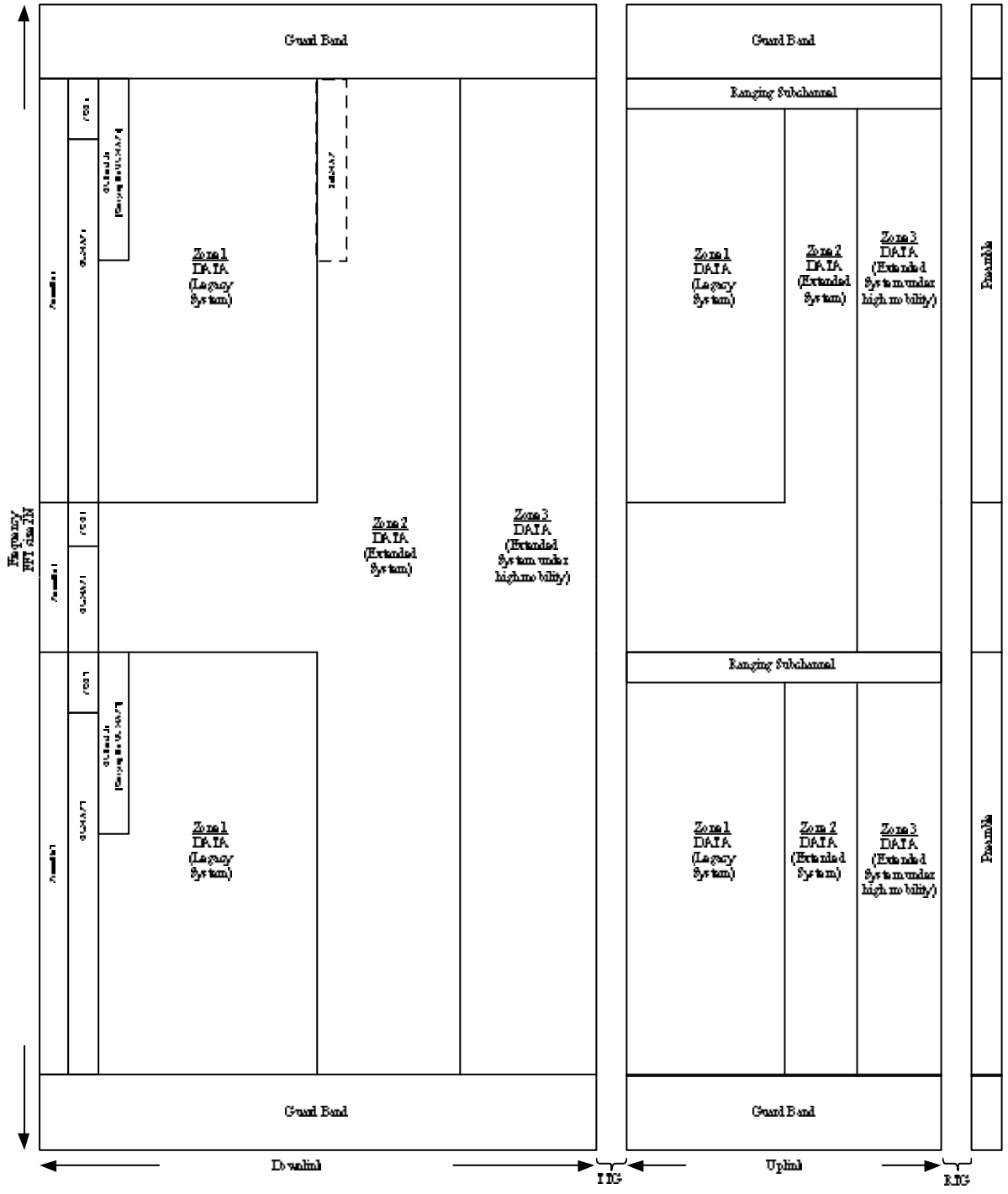

Figure 5 ExampleTDD OFDMA frame structure for IEEE 802.16m with a scalable bandwidth in high-mobility environment (1)

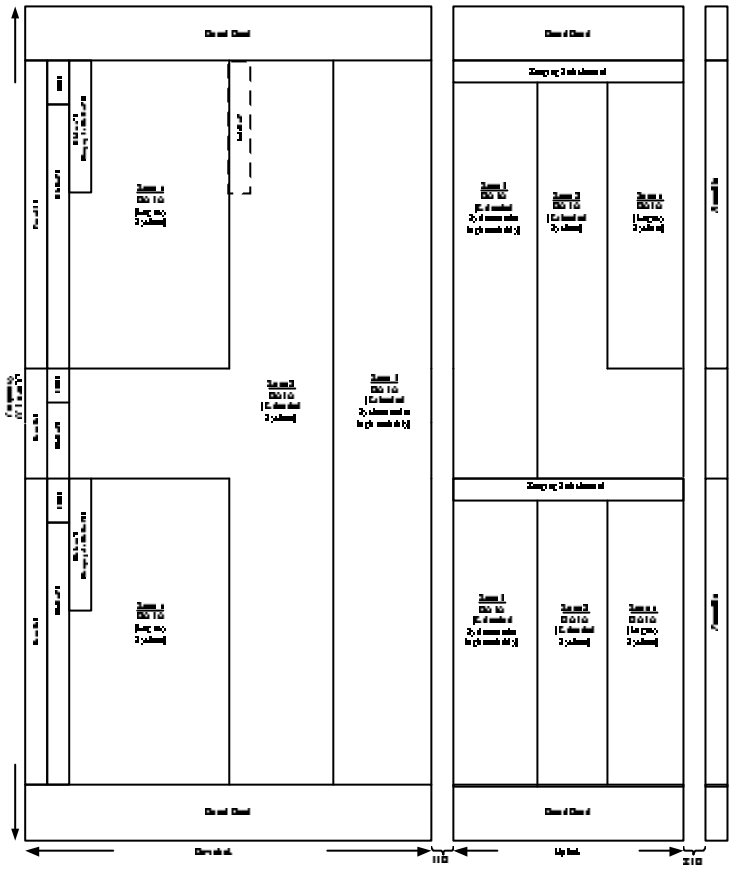

Figure 6 A Figure 5 ExampleTDD OFDMA frame structure for IEEE 802.16m with a scalable bandwidth in high- mobility environment (2)

References

[1] IEEE 802.16m-07/002, “802.16m System Requirements, ” IEEE 802.16m-07/002r4.

[2] IEEE 802.16m-07/037r1, “Draft 802.16m Evaluation Methodology, ” IEEE 802.16m-07/037r1.