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Title	**Proposal for IEEE 802.16m Frame Structure for Single Band Operation**
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Re:	IEEE 802.16m-07/047– Call for Contributions on Project 802.16m System Description Document (SDD)
Abstract	This contribution proposes the IEEE 802.16m frame structure for single band operation.
Purpose	To incorporate the proposed frame structure into the Project 802.16m System Description Document
Notice	
Release	
Patent Policy	

Proposal for IEEE 802.16m Frame Structure for Single Band Operation

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1 Introduction

This contribution proposes the IEEE 802.16m frame structure for single band operation, which is applicable to the following cases: 1) both IEEE 802.16m MS and BS operate on the same system bandwidth; 2) both IEEE 802.16m and the legacy systems operate on the same system bandwidth. Frame structure for multi-band operation is proposed in a separate contribution (C802.16m-08/042).

2 General Consideration

To allow coherent design and minimize implementation complexity, the same generic framework is proposed to support both legacy mode and non-legacy mode

Multiple access scheme for both DL and UL is OFDMA as in the legacy system. We propose to adopt the same OFDMA numerology as the legacy system is used for unicast transmission.

3 Generic Frame Structure

The IEEE 802.16m generic frame structure is shown in Figure 1 to support both legacy mode and non-legacy mode. The generic frame structure consists of superframe, frame (for the case of legacy mode) and mini-slot. For non-legacy mode, each superframe consists of N mini-slots. For legacy mode, each superframe is divided into K 5ms frames and each frame is further divided into J mini-slot. $N = K*J$. Recommended values are K = 4, J = 8, N = 32. Each mini-slot consists of 6 symbols. Each superframe starts with a 16m preamble mini-slot which contains the following: 1) Synchronization channel; 2) System broadcast channel.

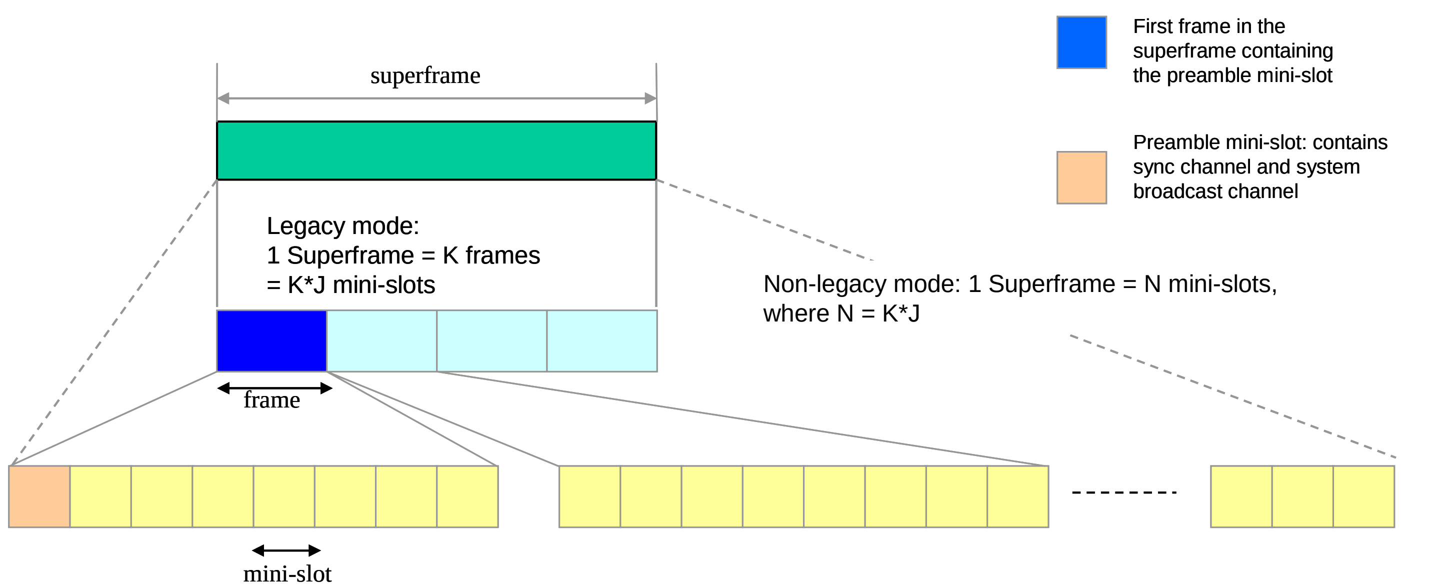

Figure 1 IEEE 802.16m Generic Frame Structure

3.1 Legacy Mode

IEEE 802.16m and legacy systems are overlaid in a TDM fashion when both occupy the same bandwidth. Legacy TDM zone and IEEE 802.16m TDM zone are defined within the DL sub-frame and the UL sub-frame. Legacy zones are located at the beginning of the legacy DL sub-frame and the legacy UL sub-frame. Different TDD ratios can be configured for the legacy system and the IEEE 802.16m system

For the case of UL, FDM partitioning of resource between IEEE 802.16m and legacy systems are for further study. FDM partitioning can provide better UL coverage at the expense of imposing constraint on the UL channelization format of IEEE 802.16m

3.1.1 Superframe, Frame and Mini-Slot

A detailed frame structure for the legacy mode, consist of superframe, frame and mini-slot is shown in Figure 2.

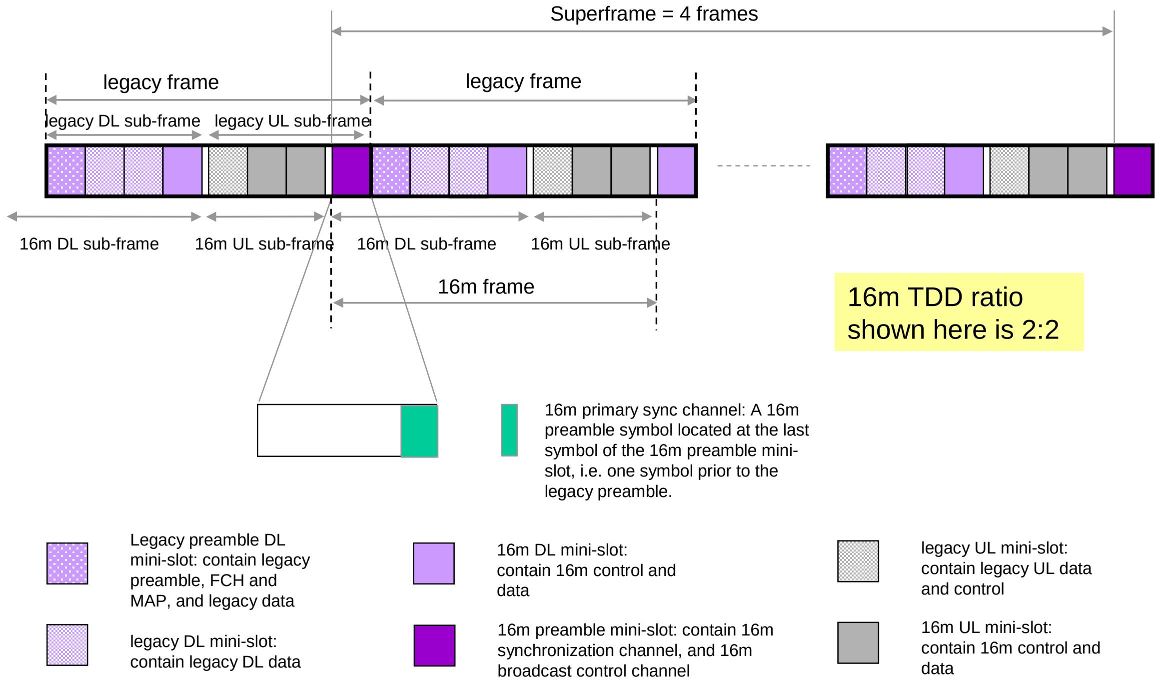

Figure 2 Frame Structure for Legacy Mode

A legacy 5ms frame is divided into 8 mini-slots, each containing 6 symbols. At least one mini-slot is assigned for DL legacy zone. At least one mini-slot is assigned for the UL legacy zone. Zero or more mini-slots are assigned for the DL IEEE 802.16m zone. Zero or more mini-slots are assigned for the UL IEEE 802.16m zone. The first mini-slot in a legacy frame is the legacy preamble mini-slot. One symbol in the legacy preamble mini-slot is punctured for use as TTG/RTG. The remaining 5 symbols consist of preamble, FCH, MAP and possibly legacy data zone. The legacy DL sub-frame always starts with the legacy preamble mini-slot. The legacy UL sub-frame always starts with the legacy UL mini-slot.

The IEEE 802.16m frame is offset to the legacy frame by one mini-slot in advanced. A 16m preamble mini-slot is located at the beginning of each superframe. It contains the 16m primary synchronization channel and the 16m broadcast control channel. An IEEE 802.16m mini-slot contains both IEEE 802.16m control and data. The

IEEE 802.16m channelization for control and data is confined within the mini-slot. IEEE 802.16m TDD ratios are defined as M:N where M is the number of IEEE 802.16m DL mini-slots in a frame and N is the number of IEEE 802.16m UL mini-slots in a frame. There is one DL-UL TDD switch and one UL-DL TDD switch for IEEE 802.16m in each 5ms frame. Larger number of TDD switches is FFS.

3.1.2 16m Preamble for Legacy Mode

A IEEE 802.16m MS uses both legacy preamble and 16m preamble for synchronization and system access. The 16m primary synchronization channel is the last symbol in the 16m preamble mini-slot. It is a 16m specific preamble used for the following purposes:

1) Fast synchronization;

2) Indication of whether legacy support is enabled in the IEEE 802.16m system. With this indication, the format of the 16m preamble mini-slot, and the relationship and boundaries between superframe, frame and mini-slot can be deduced by the MS.

The legacy preamble is used as the16m secondary synchronization channel. It is used for the following purposes:

1) Contains cell specific sequence for cell search and best sector(s) selection;

2) Fine synchronization.

3.2 Non-Legacy Mode

When legacy support is disabled, a superframe maps to mini-slots. There is no need to define frame boundary. A superframe consists of 32 mini-slots. TDD ratio is defined as *M*:*N* where *M* is the number of consecutive DL mini-slots and *N* is the number of consecutive UL mini-slots.

A detailed frame structure of the non-legacy mode is shown in Figure 3. As in the case of legacy mode, a 16m preamble mini-slot is located at the beginning of a superframe. It contains the 16m primary synchronization channel, i.e., the second last symbol in the 16m preamble mini-slot; the 16m secondary synchronization channel, i.e., the last symbol in the 16m preamble mini-slot; and the 16m broadcast control channel.

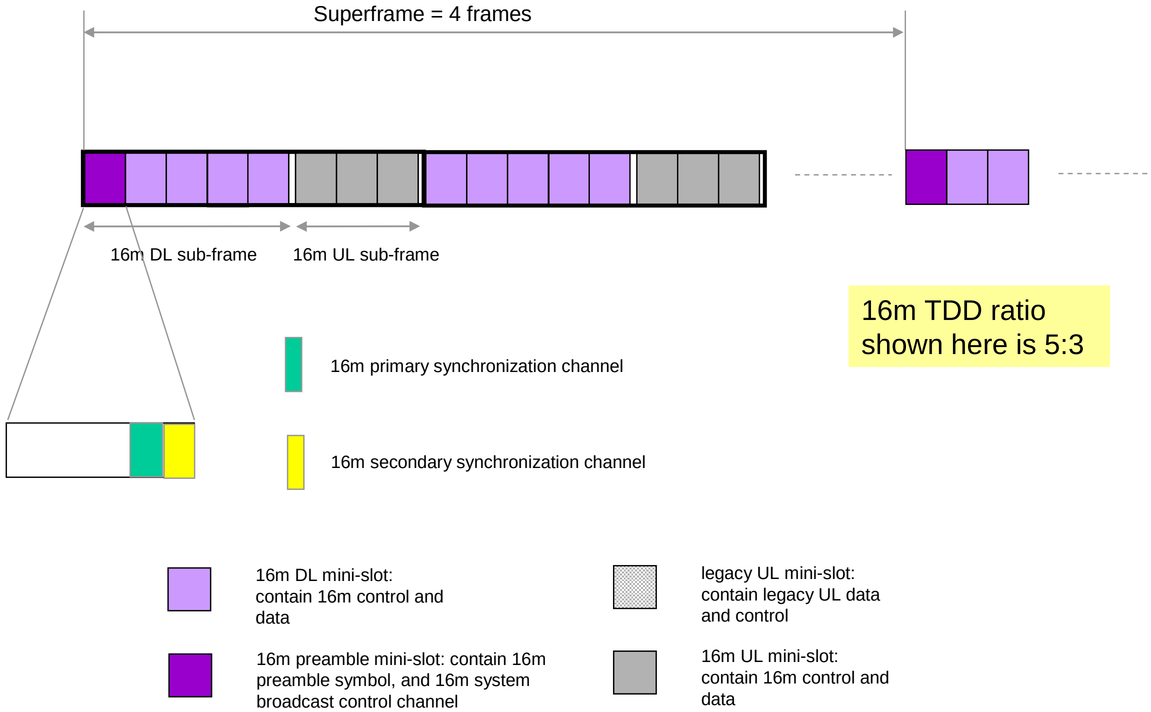

Figure 3 Frame Structure for Non-Legacy Mode

3.2.1 16m Preamble for Non-Legacy Mode

The same primary and secondary synchronization channels as defined for legacy mode are used for non-legacy mode. An IEEE 802.16m MS uses the same synchronization and system access procedure for both legacy and non-legacy mode.

As in the case of legacy mode, the 16m primary synchronization channel is used for following:

1) Fast synchronization;
2) Indication of whether legacy support is enabled in the IEEE 802.16m system. With this indication, the format of the 16m preamble mini-slot, and the relationship and boundaries between superframe, frame and mini-slot can be deduced by the MS.

As in the case of legacy mode, the 16m secondary synchronization channel has the same sequence construct as the legacy preamble to ensure the 16m MS employs the same synchronization and system access procedure regardless of whether legacy support is enabled or not. It is used for the following:

1) Contains cell specific sequence for cell search and best sector(s) selection;
2) Fine synchronization

3.3 Channelization and Control Channel Design

New channelization and control channel design are defined for IEEE 802.16m mini-slots. The channelization for control and traffic is confined within each mini-slot and span across all the symbols within the mini-slot. Extended mini-slots can be defined to concatenate the sub-channel resource across multiple mini-slots to reduce control overhead and improve UL coverage. This is FFS.

3.4 HARQ Timing

Figure 4 and Figure 5 show the DL HARQ timing and the UL HARQ timing respectively for synchronous HARQ. The minimum HARQ ACK and retransmission delay and the number of HARQ channels are defined in system broadcast signaling which corresponds to particular partitioning of legacy and 16m, and TDD ratios. With these parameters defined, the precise HARQ timing can be deduced.

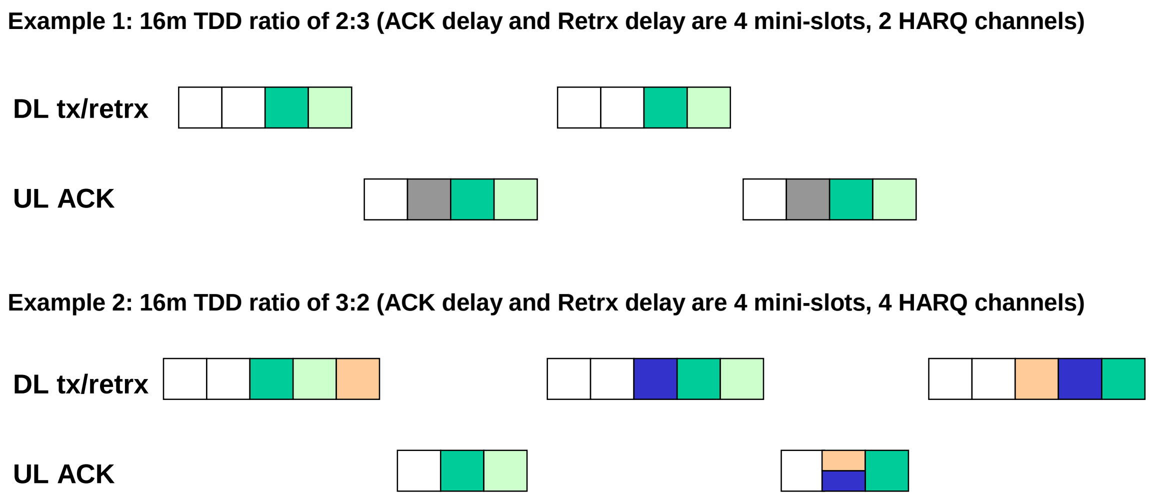

Figure 4 DL HARQ Timing

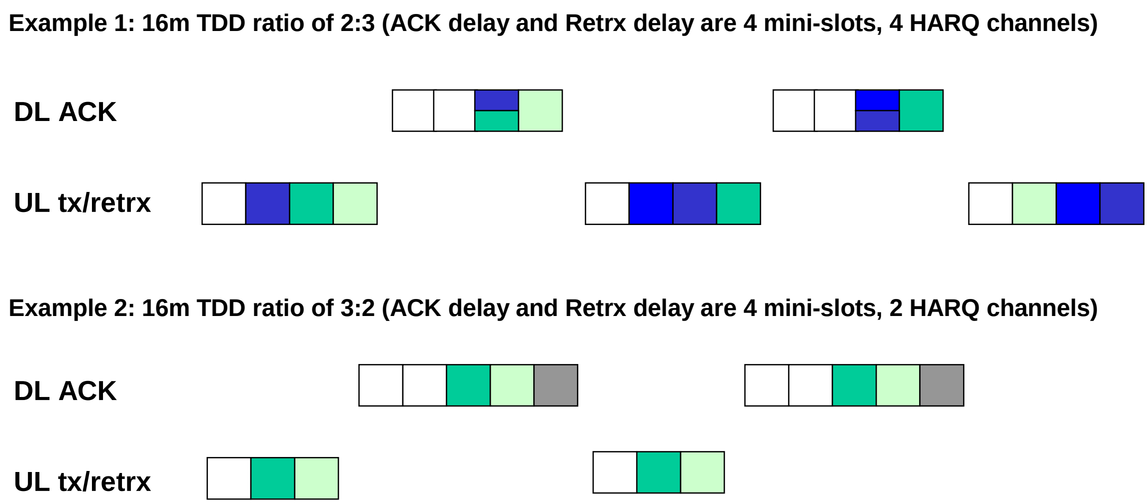

Figure 5 DL HARQ Timing

4 Proposed Text for SDD

[Create the following sub-sections in section 11 of the SDD]

11.1 Single-Band Support

11.1.1 Frame Structure without Relay

[Within 11.1.1, insert the text in Section 3 and its subsequent sub-sections in this contribution to this sub-section of the SDD]

11.1.2 Frame Structure with Relay

11.2 Multi-Band Support

11.2.1 Frame Structure without Relay

11.2.2 Frame Structure with Relay