Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Proposal for IEEE 802.16m Frame Structure and Protocol Architecture for Multi-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 and protocol architecture for multi-band operation.
Purpose	To incorporate the proposed frame structure and protocol architecture into the Project 802.16m System Description Document
Notice	
Release	
Patent Policy	

Proposal for IEEE 802.16m Frame Structure and Protocol Architecture for Multi-Band Operation

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1 Introduction

This contribution proposes the IEEE 802.16m frame structure for multi-band operation, which is applicable to the following cases: 1) IEEE 802.16m MSs operate on a smaller or equal bandwidth than the IEEE 802.16m BS; 2) legacy MSs operate on a smaller or equal bandwidth than the IEEE 802.16m BS

Basic frame structure for single-band operation is presented in a separate contribution (C802.16m-08/041). The frame structure proposed in this contribution is based on the basic framework proposed in C802.16m-08/041.

2 General Consideration

The IEEE 802.16m BS can operate in single carrier or multi-carrier modes.

In single carrier mode, a single wideband FFT that spans the system bandwidth is used at the BS. The BS supports MS (legacy MS and 16m MS) with different bandwidth capabilities up to the system bandwidth. This mode is suitable for the case of contiguous spectrum allocation.

In multi-carrier mode, the system bandwidth is segmented into multiple smaller bands. A separate FFT and filter is used at each band. The BS supports MS with different bandwidth capability up to the system bandwidth. This mode is suitable for the case of non-contiguous spectrum allocation and for operator carrier-upgrade scenario.

It should be noted that allowing 16m MSs with different bandwidth capabilities in IEEE 802.16m standards has implication on system overhead. Guard band is required between adjacent bands within the system bandwidth. In addition, 16m preamble and broadcast signaling has to be present in the bands that support the corresponding types of 16m MSs

3 Singer Carrier Mode

Figure 1 provides an illustration of the combinations of BS and MS operating bandwidth. An IEEE 802.16m BS can configure the system bandwidth into different bands to support legacy and 16m MSs with different bandwidth capabilities. Guard band is required between bands. The bandwidth partitioning can change from one 16m mini-slot to another. After initial network entry, an MS is semi-statically assigned to a center frequency or carrier for transmission/reception. A 16m MS with a particular bandwidth capability can be assigned resource in bands that have the same or lower bandwidth. A wideband MS can be assigned resource on different smaller bands and across multiple smaller bands as long as the overall bandwidth window is within the reception window of the MS.

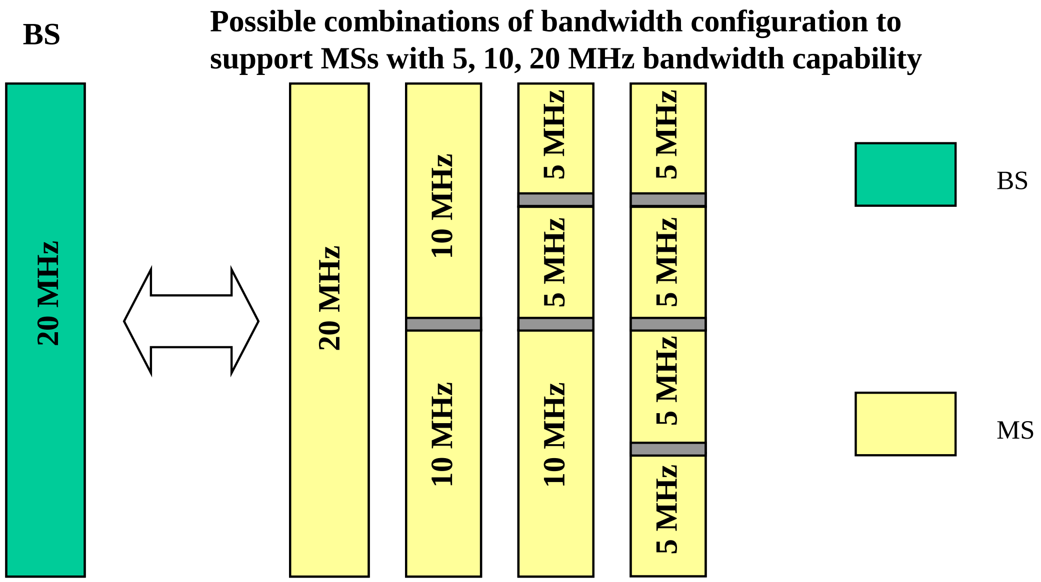

Figure 1 Illustration of the Combinations of BS and MS Operating Bandwidth

3.1 Frame Structure for Single Carrier Mode

Figure 2 shows the frame structure for the single carrier mode. Within the system bandwidth, there can be zero or multiple legacy-only bands, zero or multiple mixed (legacy plus 16m) bands and zero or multiple 16m-only bands. In the example shown in Figure 2, the system bandwidth is 20MHz. There is one 5MHz legacy-only band, one 5MHz mixed band, and one 10MHz 16m-only band. The frame structure of the mixed band and the 16m-only band are as defined in C802.16m-08/041.

On a particular mini-slot where 16m mini-slot is defined for adjacent bands, guard bands between these adjacent bands are optional, i.e. no guard bands when the mini-slot is used to assign resource to wideband 16m MS.
The example shown in Figure 2 is for the case of 16m MSs bandwidth capabilities of 5MHz, 10MHz, and 20MHz. Therefore, preamble mini-slot has to be present in each band to provide synchronization and cell search function to MSs anchored on each band. If all 16m MSs have 20MHz bandwidth capability and therefore can simultaneously decode multiple bands, the 16m preamble mini-slot only needs to be present in one of the bands.

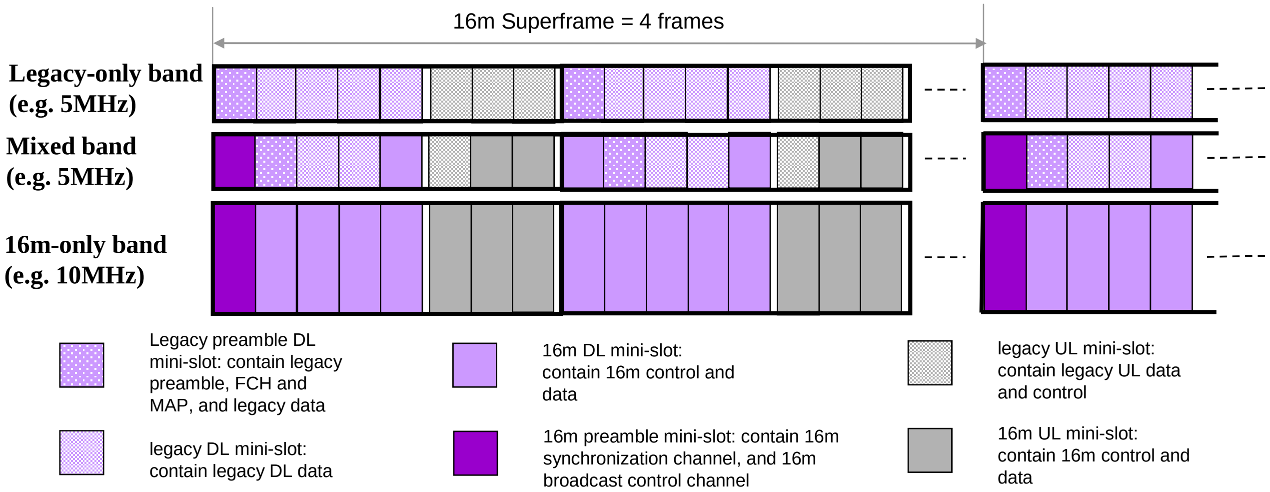

Figure 2 Frame Structure for Single Carrier Mode

4 Multi-Carrier Mode

Figure 3 provides an illustration of the combinations of BS and MS operating bandwidth. The system bandwidth is statically configured into multiple bands, each with separate RF and baseband processing. Guard band is required between bands. After initial network entry, an MS is semi-statically assigned to a center frequency or carrier for transmission/reception. A 16m MS with a particular bandwidth capability can be assigned to bands that have the same or lower bandwidth. A wideband MS can be assigned resource on different smaller bands and across multiple smaller bands as long as the overall bandwidth window is within the reception window of the MS.

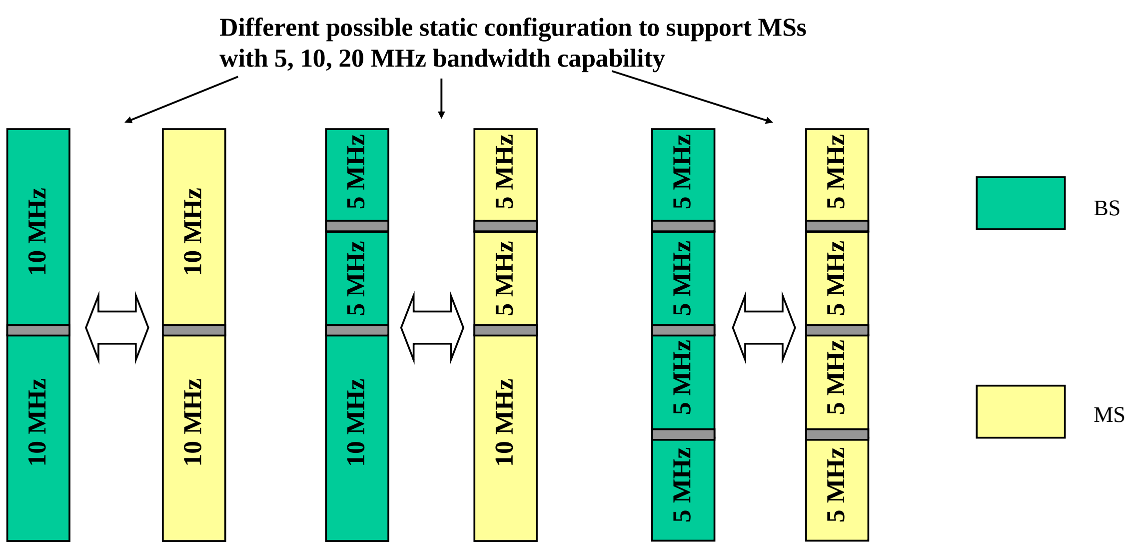

Figure 3 Illustration of the Combinations of BS and MS Operating Bandwidth

4.1 Frame Structure for Multi-Carrier Mode

Figure 4 shows the frame structure for the multi-carrier mode. Within the system bandwidth, there can be zero or multiple legacy-only bands, zero or multiple mixed (legacy plus 16m) bands and zero or multiple 16m-only bands. In the example shown in Figure 4, the system bandwidth is 20MHz. There is one 5MHz legacy-only band, one 5MHz mixed band, and one 10MHz 16m-only band. The frame structure of the mixed band and the 16m-only band are as defined in C802.16m-08/041.

The example shown in Figure 4 is for the case of 16m MSs bandwidth capability of 5MHz, 10MHz, and 20MHz. Therefore, preamble mini-slot has to be present in each band. If all 16m MSs have 20MHz bandwidth capability and can simultaneously decode multiple bands, the 16m preamble mini-slot only needs to be present in one of the bands.

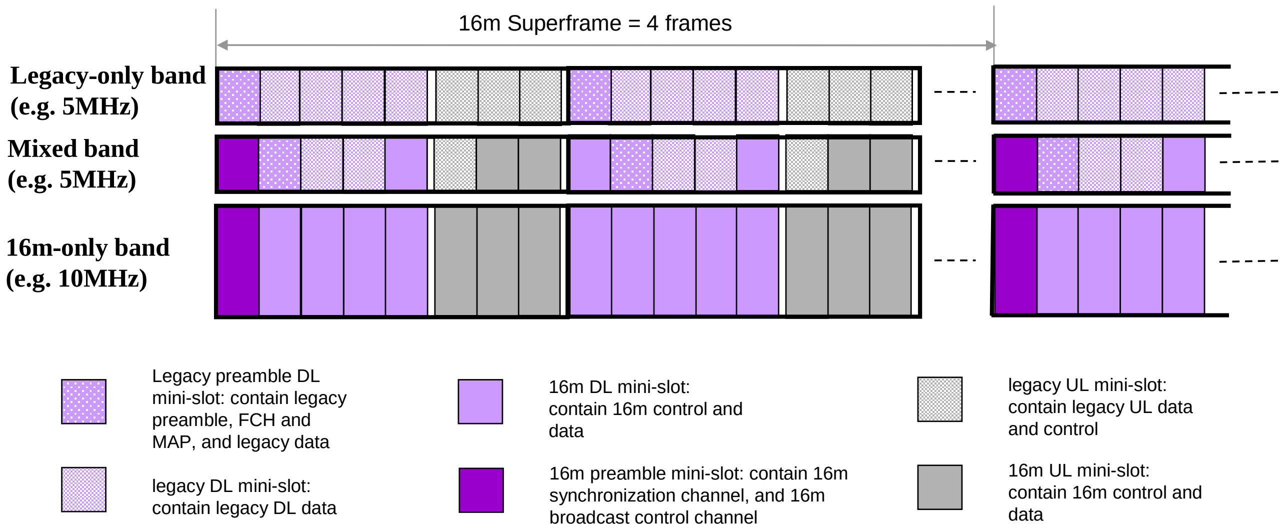

Figure 4 Frame Structure for Single Carrier Mode

5 Protocol Structure of Multi-Band Operation

The same generic protocol structure should be used to support single band and multi-band operation within IEEE 802.16m. Each band can be viewed as a PHY entity. Control and resource management across multiple bands or PHY entities are performed by the same set of MAC protocol functions.

Figure 5 shows the IEEE 802.16m MAC functions. The functions involved in multi-band operation are highlighted in ‘yellow’.

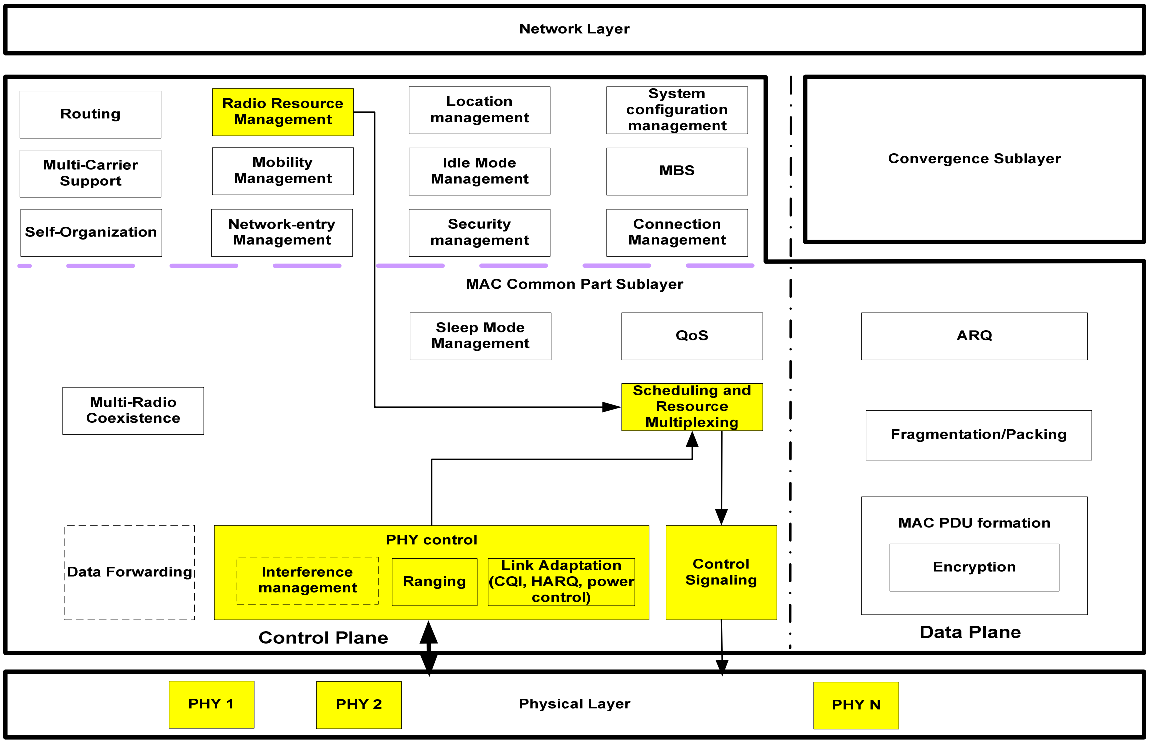

Figure 5 MAC Functions for Multi-Band Operation

6 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

11.1.2 Frame Structure with Relay

11.2 Multi-Band Support

11.2.1 Frame Structure without Relay

[Within 11.2.2, insert the text in Section 3 and its subsequent sub-sections in this contribution to sub-section 11.2.1.1 of the SDD. Insert the text in Section 4 and its subsequent sub-sections in this contribution to sub-section 11.2.1.2 of the SDD.]

11.2.2 Frame Structure with Relay

[Insert the text in Section 5 in this contribution to sub-section 8.1 of the SDD.]