

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

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Purpose: Adopt the proposal into the IEEE 802.16m System Description Document

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Scope

- This contribution presents the IEEE 802.16m frame structure for multi-band operation, i.e.
 - IEEE 802.16m MSs operate on a smaller or equal bandwidth than the IEEE 802.16m BS
 - 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 C802.16m-08/041.

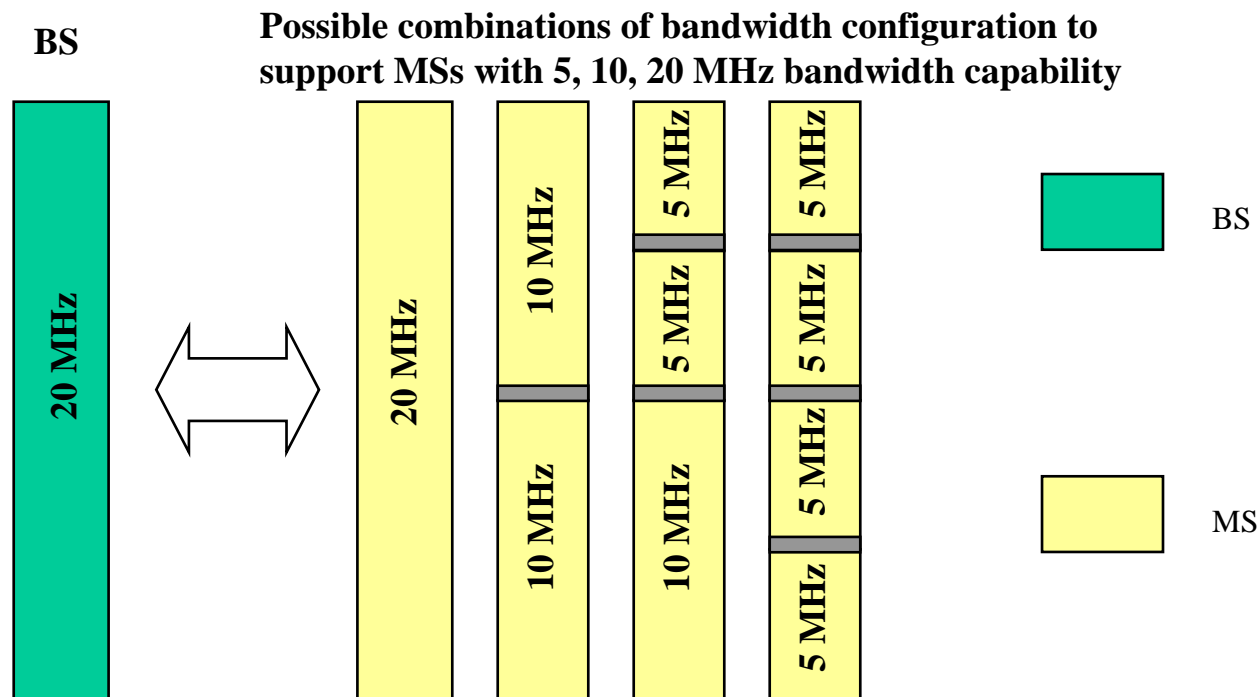
Overview

- The IEEE 802.16m BS can operate in single carrier or multi-carrier modes
- Single carrier mode:
 - A single wideband FFT that spans the system bandwidth is used at the BS
 - Support 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
- Multi-carrier mode:
 - The system bandwidth is segmented into multiple smaller bands. A separate FFT and filter is used at each band.
 - Support 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.

Consideration for 16m MS Bandwidth Capability

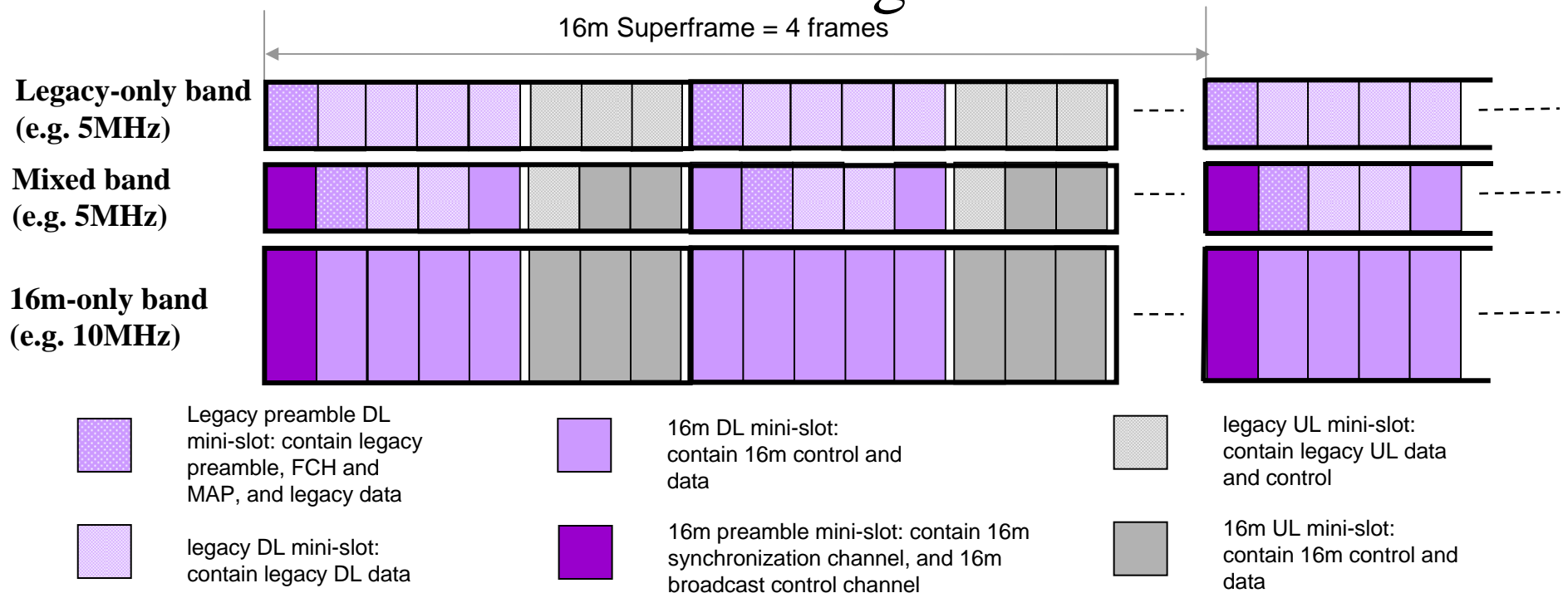
- Allowing 16m MSs with different bandwidth capability in IEEE 802.16m standards has implication on system overhead
 - Guard band is required between adjacent bands within the system bandwidth
 - 16m preamble and broadcast signaling has to be present in the bands that support the corresponding types of 16m MSs

Illustration of BS and MS Operating Bandwidth for Single Carrier Mode



- A 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.

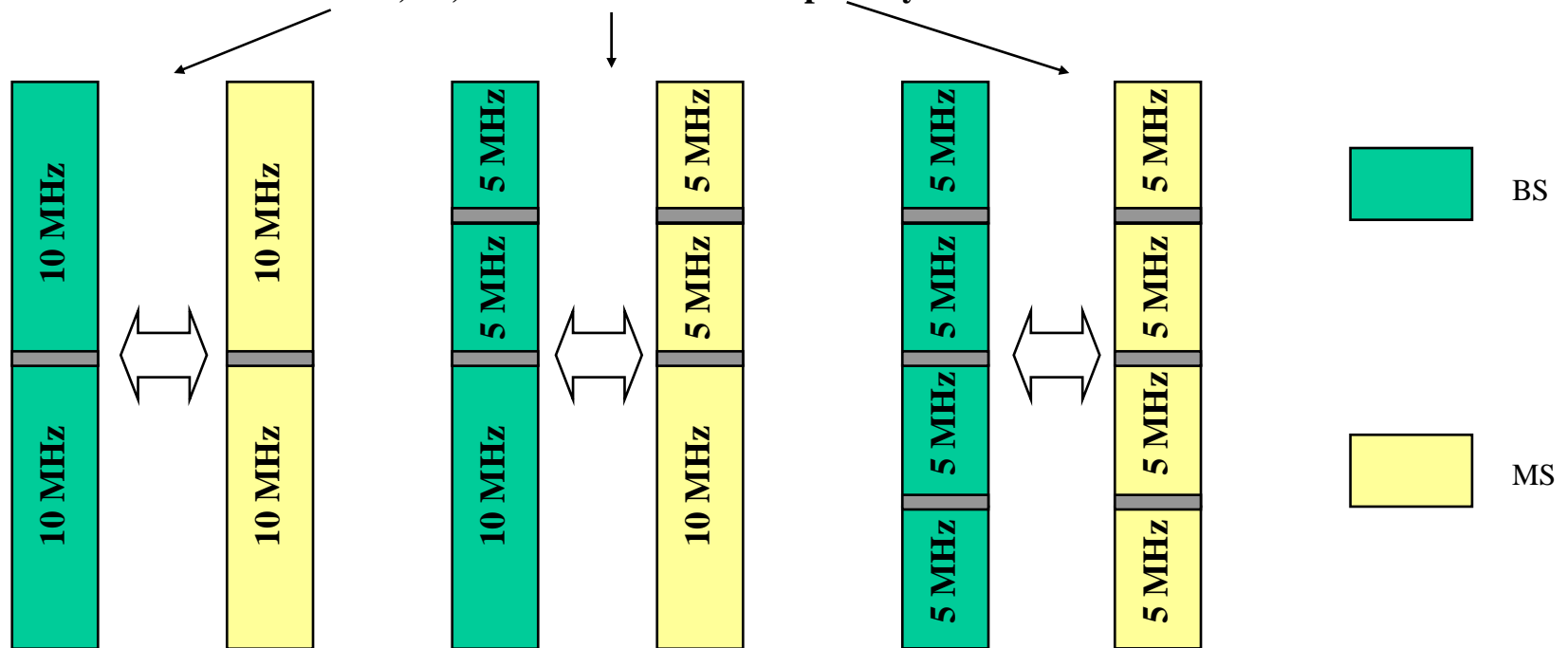
Frame Structure for Single Carrier Mode



- 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
- 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.
- Example above shows the case of 16m MSs bandwidth capability of 5MHz, 10MHz, and 20MHz. Therefore, preamble mini-slot has to be present in each band to provide synchronization and cell search functions 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.

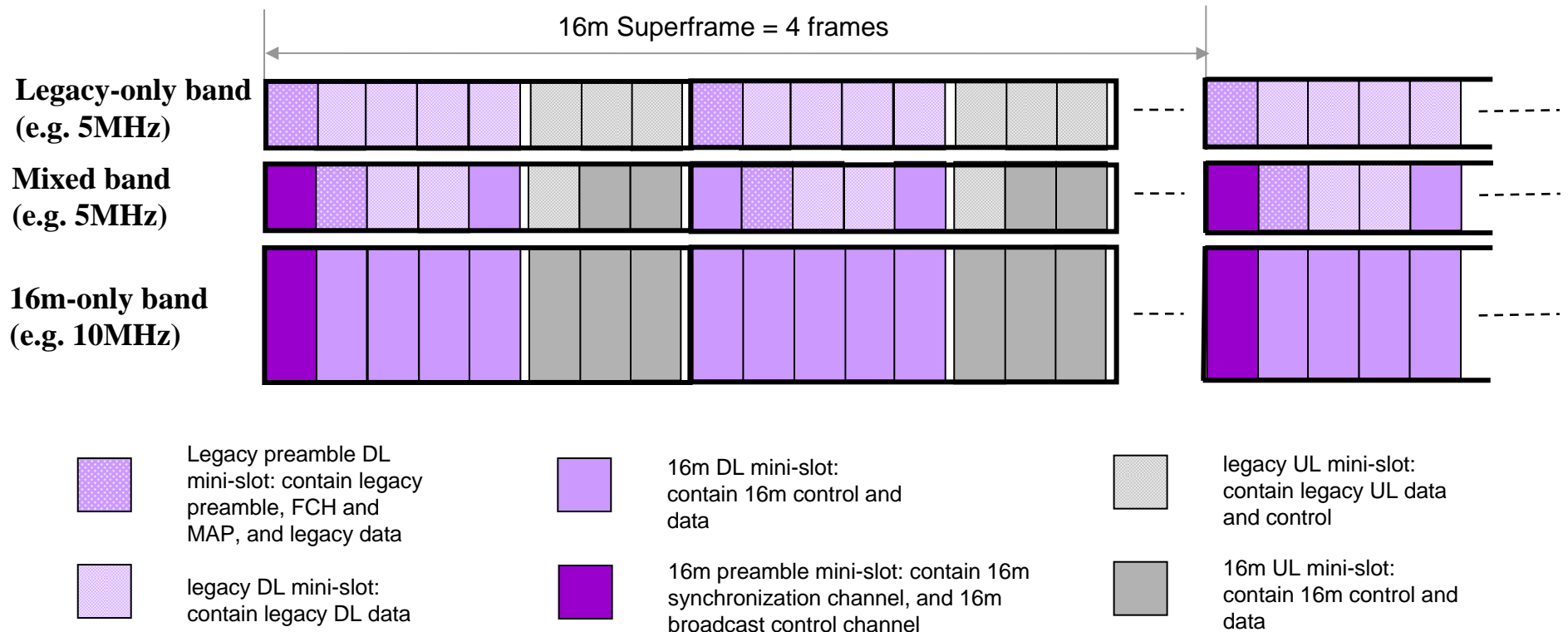
Illustration of BS and MS Operating Bandwidth for Multi-Carrier Mode

Different possible static configuration to support MSs with 5, 10, 20 MHz bandwidth capability



- 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.

Frame Structure for Multi-Carrier Mode



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Protocol Structure for 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

MAC Functions for Multi-Band Operation

