

# Proposal for IEEE 802.16m Multi-Carrier Configuration

Document Number: IEEE C802.16m-08/355

Date Submitted: 2008-05-05

Source:

Mo-Han Fong, Sophie Vrzic, Robert Novak, Jun Yuan, Dongsheng Yu, Sang-Youb Kim, Kathiravetpillai Sivanesan, Anna T

Nortel Networks

E-mail: [mhfong@nortel.com](mailto:mhfong@nortel.com)

\*<http://standards.ieee.org/faqs/affiliationFAQ.html>>

Re: IEEE 802.16m-08/016r1 – Call for Contributions on Project 802.16m System Description Document (SDD), on the content of IEEE 802.16m-08/003r1.

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

Notice:

*This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the “Source(s)” field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.*

Release:

The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE’s name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE’s sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

Patent Policy:

The contributor is familiar with the IEEE-SA Patent Policy and Procedures:

<http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>.

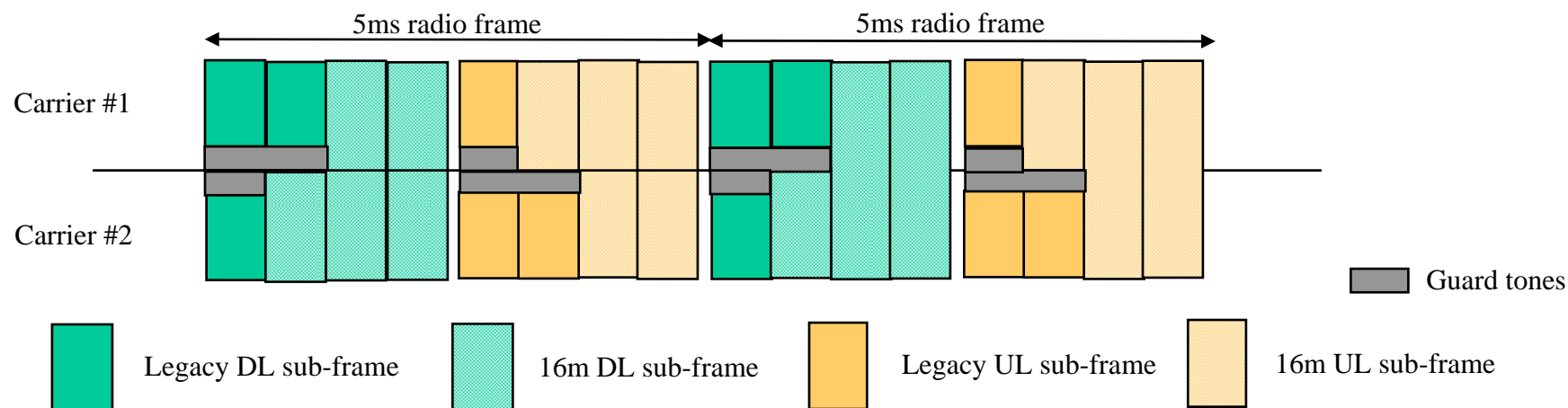
Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat> >.

# Introduction

- Multi-carrier support has been introduced in IEEE 802.16-08/003r1 in Section 8.1.3.
- Details of adjacent carriers configuration such as carrier spacing, sub-carrier alignment, guard tones etc. have not been addressed in the SDD.
- This contribution proposes the adjacent carriers configuration regarding carrier spacing, sub-carrier alignment and guard tones when some of the carriers are legacy support carrier.

# Multi-Carrier Configurations – 1/4

- To support backward compatibility, 3 sets of OFDM sub-carrier spacing are adopted in IEEE 802.16m-08/003r1.
- For the cases of sub-carrier spacing of 7.81kHz and 9.77kHz, the corresponding system bandwidth (thus the center frequencies spacing) is divisible by the sub-carrier spacing. Therefore, in a multi-carrier deployment, the center frequencies of adjacent carriers are spaced by integer number of sub-carriers.
  - Therefore, no guard tones between adjacent carriers beyond the carrier bandwidth are required on sub-frames within the 16m zone.
  - To support backward compatibility, sub-frames within the legacy zone contain guard tones as defined in the legacy system permutation formats.
  - The legacy zone and the 16m zone of adjacent carriers may not be aligned as shown in Figure 1. However, the above guard tones requirement still applies.

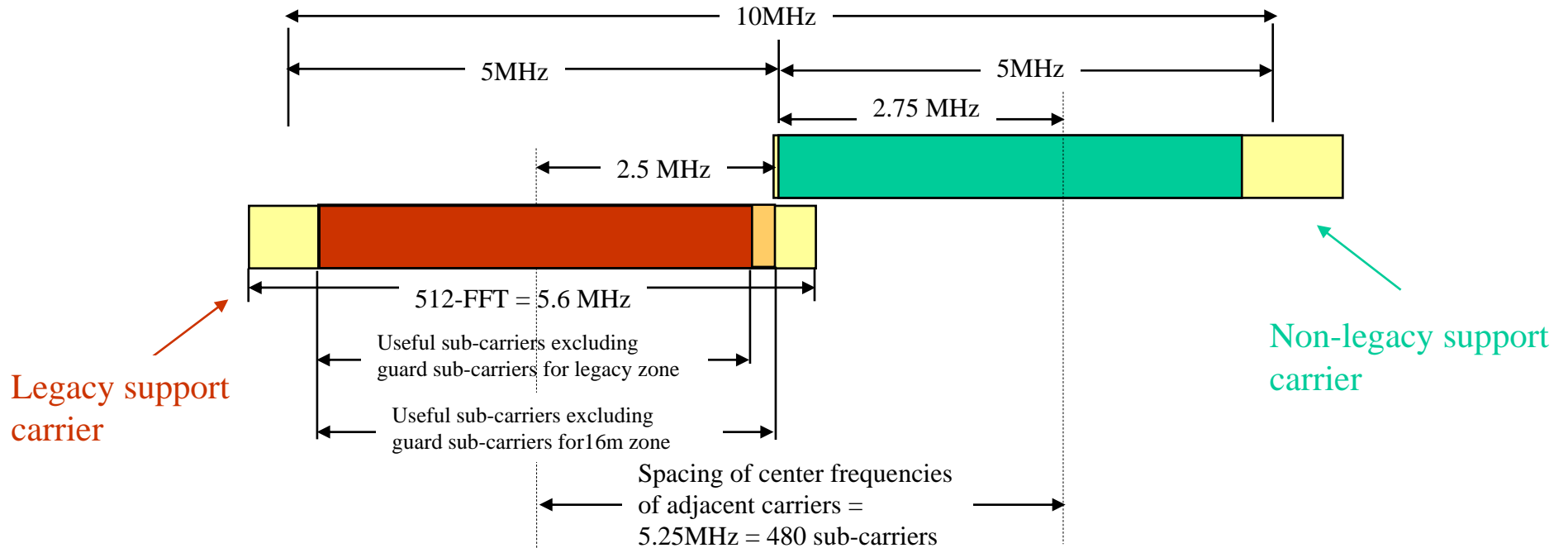


**Figure 1 Guard tones of adjacent carriers for legacy sub-frames and 16m sub-frames, when center frequencies of adjacent carriers are spaced by integer number of sub-carriers**

# Multi-Carrier Configurations – 2/4

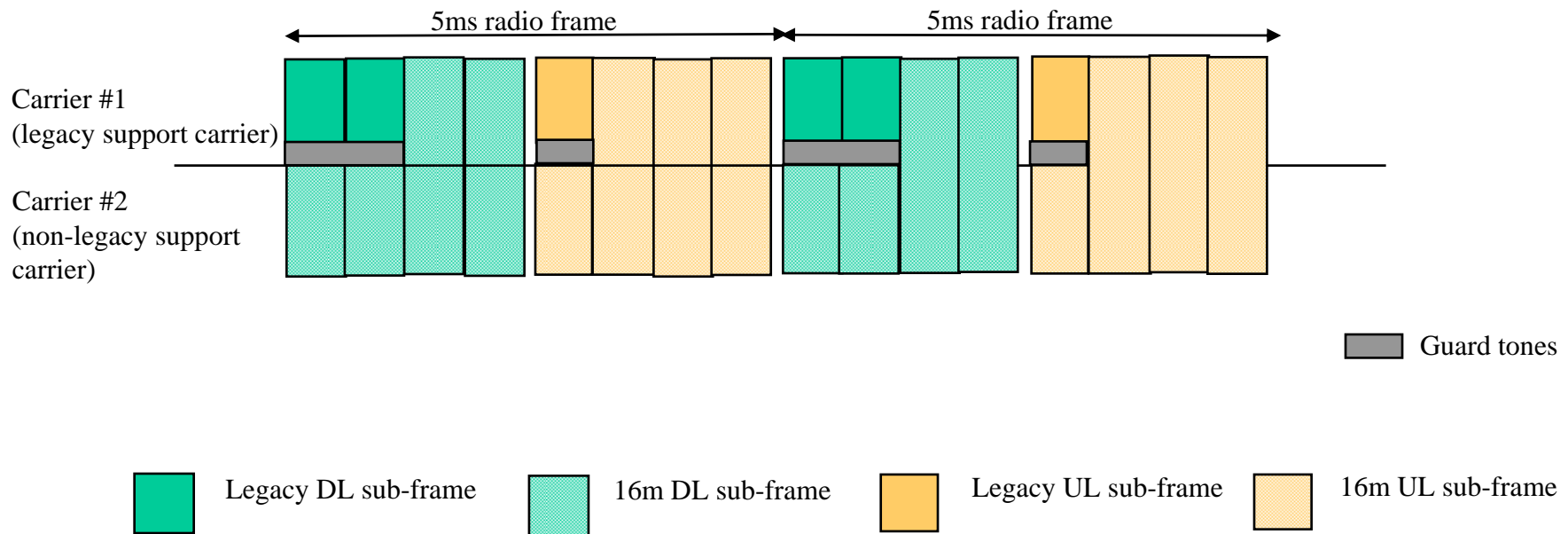
- For the case of sub-carrier spacing of 10.94kHz, the corresponding system bandwidths of 5/10/20MHz are not divisible by the sub-carrier spacing. In addition, the center frequency of each carrier needs to align with the raster, i.e. 250kHz
  - $7 \times 250\text{kHz} = 1.75\text{MHz}$  is divisible by 10.94kHz
  - Therefore,  $N \times 1.75\text{MHz}$ , e.g. 5.25MHz, 10.5MHz, 21MHz are divisible by the sub-carrier spacing.
- If both adjacent carriers are legacy support carriers, the center frequencies of the adjacent carriers are spaced by the carrier bandwidths in order to ensure backward compatibility. Guard tones are required between the adjacent carriers.
- If a non-legacy support carrier is adjacent to a legacy support carrier, the center frequency of the non-legacy carrier can be offset such that the center frequencies of the two adjacent carriers can be spaced by 5.25/10.5/21MHz respectively for carrier bandwidth of 5/10/20MHz respectively. An illustration for carrier bandwidth of 5MHz is shown in Figure 2 (next slide).
  - On sub-frame within the 16m zone, no guard tones are required between adjacent carriers beyond the carrier bandwidth (see Figure 3, next slide).
  - On sub-frame within the legacy zone, guard tones are still required on sub-frames within the legacy zone (see Figure 3, next slide).
  - For the non-legacy carrier, as shown in Figure 2 (next slide), uneven number of guard sub-carriers are used on both sides of a carrier

# Multi-Carrier Configurations – 3/4



**Figure 2 Center frequencies spacing and guard tones of adjacent legacy enabled carrier and non-legacy carrier**

# Multi-Carrier Configurations – 4/4



**Figure 3** Guard tones of adjacent legacy enabled carrier and non-legacy carrier for legacy sub-frames and 16m sub-frames, when center frequencies of adjacent carriers are spaced by integer number of sub-carriers

# Proposed Text for SDD – 1/3

*[Add the following section and sub-sections to the SDD]*

## 11.4.7 Frame Structure Supporting Multi-carrier Operation

### 11.4.7.1 Sub-carrier Alignment between Adjacent Carrier

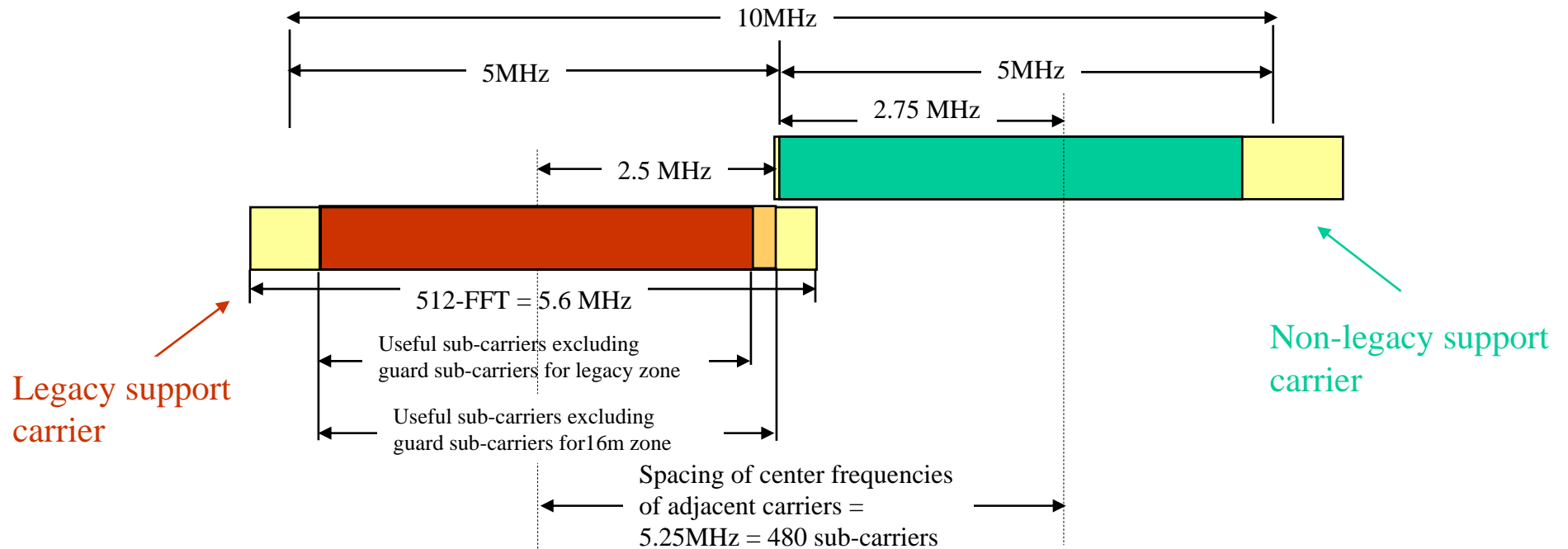
When the channel bandwidth (thus the center frequencies spacing) is divisible by the sub-carrier spacing, e.g. for the cases of sub-carrier spacing of 7.81kHz and 9.77kHz shown in Table 1, the sub-carriers between adjacent carriers are aligned. Therefore, no guard tones between adjacent carriers beyond the carrier bandwidth are required on sub-frames within the 16m zone.

When the channel bandwidth (thus the center frequencies spacing) is not divisible by the sub-carrier spacing, e.g. for the cases of sub-carrier spacing of 10.94kHz shown in Table 1, the sub-carriers between adjacent carriers are not aligned. To allow sub-carriers alignment between adjacent carriers, the center frequency of the non-legacy carrier can be offset such that the spacing between adjacent carriers are multiples of 1.75MHz. This is illustrated in Figure 11.4.7-1. Different number of guard tones are allocated on each side of the non-legacy carrier.

If both adjacent carriers are legacy enabled carriers, the center frequencies of the adjacent carriers are spaced by the carrier bandwidths in order to ensure backward compatibility. Guard tones are required between the adjacent carriers.

# Proposed Text for SDD – 2/3

[Add the following figure to SDD (continued from previous slide)]



**Figure 11.4.7-1 Center frequencies spacing and guard tones of adjacent legacy enabled carrier and non-legacy carrier**

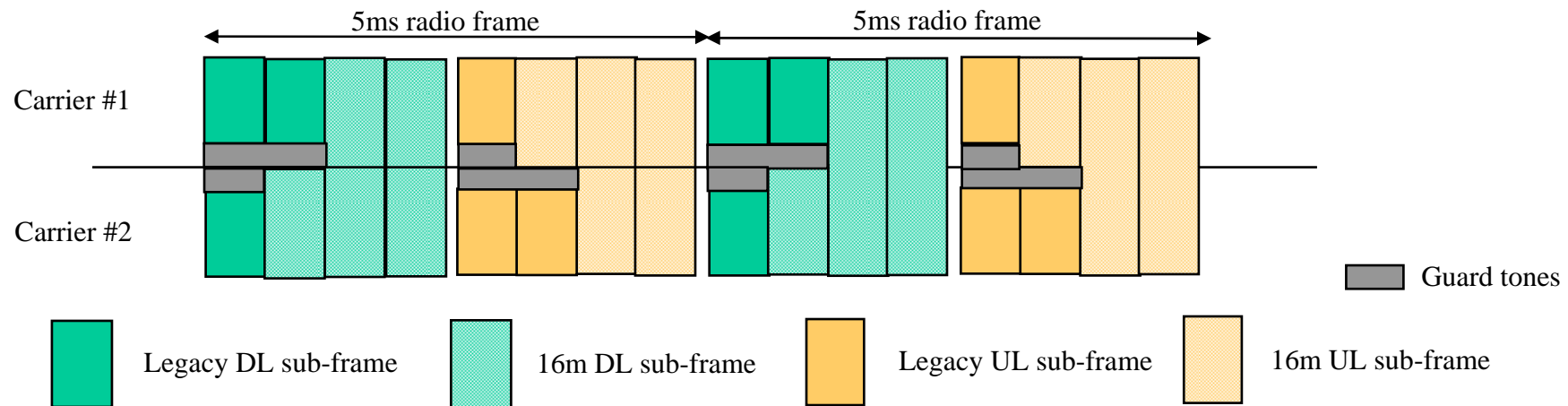


# Proposed Text for SDD – 3/3

*[Add the following section to the SDD (continued from previous slide)]*

## 11.4.7.2 Guard tones on legacy sub-frame and 16m sub-frame between adjacent carriers

Figure 11.4.7-2 illustrates the frame structure when adjacent carriers are spaced by integer number of sub-carriers. No guard tones beyond the carrier bandwidth are required on sub-frames within the 16m zone. To support backward compatibility, sub-frames within the legacy zone contain guard tones as defined in the legacy system permutation formats. The legacy zone and the 16m zone of adjacent carriers may not be aligned. However, the above guard tones requirement still applies.



**Figure 11.4.7-2 Guard tones of adjacent carriers for legacy sub-frames and 16m sub-frames, when center frequencies of adjacent carriers are spaced by integer number of sub-carriers**