Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**P802.16h Working Document structure clarification**
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Re:	Working Group Review of Working Document IEEE 802.16h-06/015r1
Abstract	This document proposes a revised structure of the P802.16h Working Document.
Purpose	
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P802.16h Working Document structure clarification

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Overview

Contributions C802.16h-06/072 [3], C802.16h-06/073 [4], and C802.16h-06/074 [5] at Session #45 suggest additions to the P802.16h Working Document [1] in a number of areas. This contribution considers the overall structure of the resulting document and where these changes are to be applied. It also provides an aid to understanding the wider goals of the group of contributions.

Structure clarification

The suggested document structure is shown diagrammatically in Figure 1.

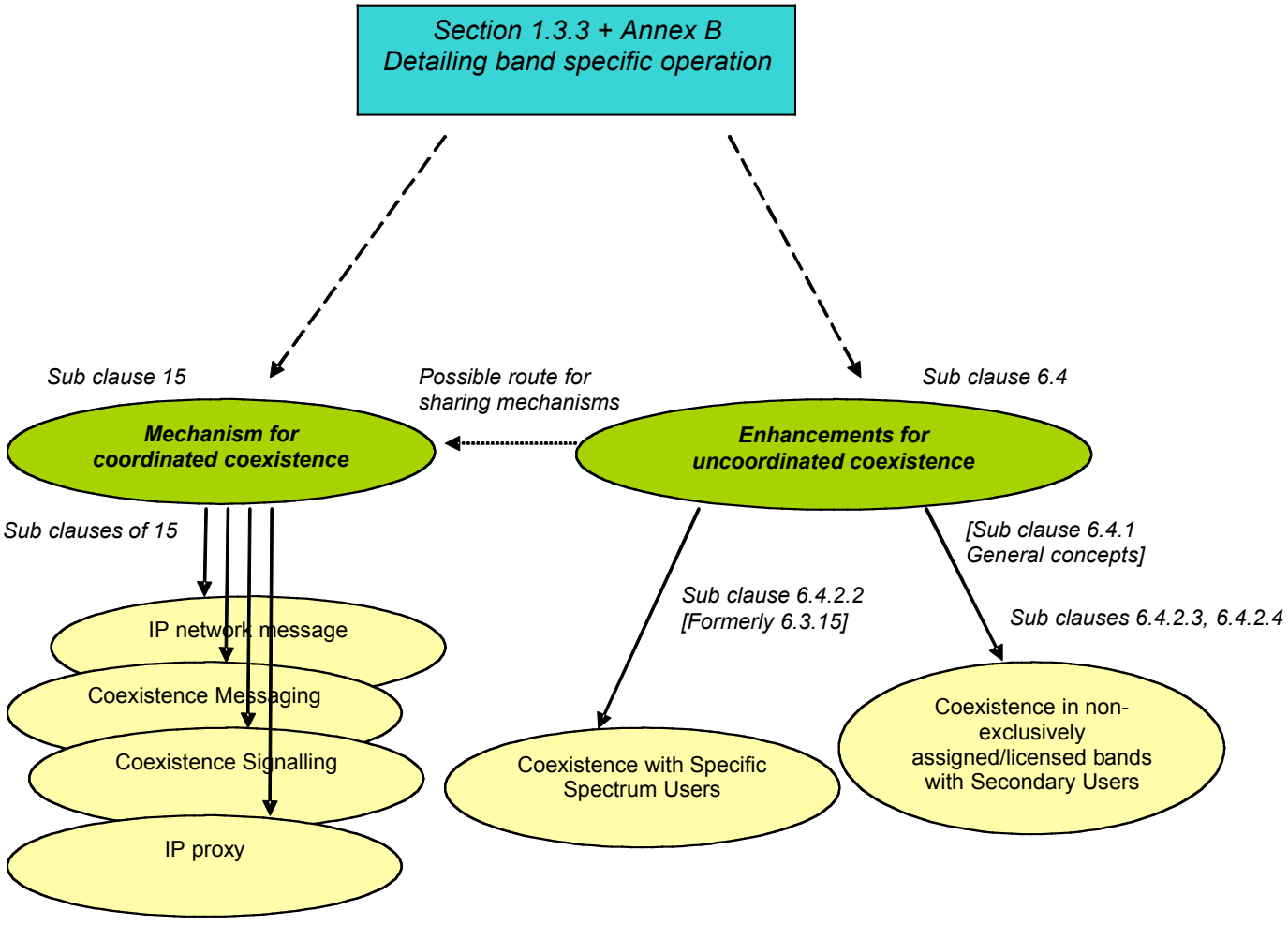

Figure 1: Representation of the suggested Working Document structure.

Per the definitions proposed below in this contribution, Clause 15 of [1] provides mechanisms of a coordinated nature. Subclause 6.4 of [1] addresses uncoordinated mechanisms. Contribution C802.16h-06/074 [5] proposes enhancements to those uncoordinated mechanisms. Contribution C802.16h-06/073 provides a summary of the band-specific operational requirements to be added to subclause 1.3.3 and Annex B. C802.16h-06/072 simply provides the definition of additional terms.

The current Working Document would add a line to Table 1 (subclause 1.3.4) of IEEE Std 802.16 designating the term WirelessMAN-CX, as shown in Figure 2:

Designation	Applicability	PHY	Additional MAC requirements	Options	Duplexing alternative
WirelessMAN-CX	Below 11 GHz license-exempt or when needed for inter-system improved coexistence	Section 8	MAC enhancements for coexistence (6.4)	Those applicable to PHY implemented. Section 15	TDD FDD

Figure 2: Designation of for WirelessMAN-CX from Table 1 of Working Document [1].

Noting, however, that the fourth column of Table 1 was deleted in IEEE 802.16e, this contribution proposes to revise that line as shown in Figure 3:

Designation	Applicability	PHY	Options	Duplexing alternative
WirelessMAN-CX	**Bands below 11 GHz subject to non-exclusive assignment or non-exclusive licensing**	**8.2, 8.3, 8.4**	**Coordinated coexistence mechanisms (Clause 15), as mandated by regulation**	**TDD** **FDD**

Figure 3: Proposed revised designation of WirelessMAN-CX entry in Table 1 of Working Document.

This contribution also proposes to revise the WirelessHUMAN line of Table 1, as shown in Figure 4:

Designation	Applicability	PHY	Options	Duplexing alternative
WirelessMAN-HUMAN	Bands below 11 GHz subject to non-exclusive assignment or non-exclusive licensing	8.2, 8.3, 8.4	AAS (6.3.7.6) ARQ (6.3.4) Mesh (6.3.6.6) (with 8.3 only) STC (8.2.1.4.3/8.3.8/8.4.8) uncoordinated coexistence mechanisms (Subclause 6.4) as mandated by regulation	TDD

Figure 4: Proposed revised WirelessMAN-HUMAN entry in Table 1 of IEEE Std 802.16.

The following subclause ordering is proposed:

1.3.3 Non-exclusively assigned and licensed bands

6.4 Enhancements for *uncoordinated* coexistence
- 6.4.1 General concepts
  - 6.4.1.1 Capability Negotiation
  - 6.4.1.2 Extended channel numbering structure
- 6.4.2 Uncoordinated coexistence mechanisms
  - 6.4.2.1 Introduction
  - 6.4.2.2 Coexistence with Specific Spectrum Users (SSUs)
  - 6.4.2.3 Uncoordinated coexistence with *Secondary Users*
    - 6.4.2.3.1 Introduction
    - 6.4.2.3.2 Dynamic Channel Selection (DCS)
  - 6.4.2.4 Uncoordinated Coexistence Protocol (UCP)
- 6.4.3 Support for uncoordinated coexistence
  - 6.4.3.1 Coexistence zones

6.4.3.2 Enhanced measurement and reporting for non-exclusively assigned or licensed bands

6.4.3.3 Extended quiet period (EQP)

6.4.3.4 Adaptive EQPs

6.4.3.5 Listen-before-talk

15 Mechanism for *coordinated* coexistence

Specific editorial changes

This section provides a list of changes to the draft document based on the discussion above.

Blue text represents specific editorial additions.

~~Red strikethrough~~ text is to be deleted.

Black text is text already in the draft.

Bold italic text is editorial instructions to the editor.

Make the following modification to subclause 1.3.3

Change the title of subclause 1.3.3 to 'Non-exclusively assigned and non-exclusively licensed bands'.

Replace the table in subclause 1.3.4 with:

Designation	Applicability	PHY	Options	Duplexing alternative
WirelessMAN-CX	Bands below 11 GHz subject to non-exclusive assignment or non-exclusive licensing	8.2, 8.3, 8.4	Coordinated coexistence mechanisms (Clause 15), as mandated by regulation	TDD FDD

~ ~ ~

Insert:

Modify the sixth row of Table 1 as follows:

Designation	Applicability	PHY	Options	Duplexing alternative
WirelessMAN-HUMAN	~~Below 11 GHz license-exempt bands~~ Bands below 11 GHz subject to non-exclusive assignment or non-exclusive licensing	~~license-exempt [8.2, 8.3 or 8.4] and 8.5~~ 8.2, 8.3, 8.4	AAS (6.3.7.6) ARQ (6.3.4) Mesh (6.3.6.6) (with 8.3 only) STC (8.2.1.4.3/8.3.8/8.4.8) uncoordinated coexistence mechanisms (Subclause 6.4) as mandated by regulation	TDD

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Make the following modification to subclause 6.4:

Change the title of subclause 6.4 from 'MAC enhancement for coexistence' to 'Enhancements for uncoordinated coexistence'.

Make the following changes to the text in subclause 6.4

This subclause describes ~~MAC~~ enhancements ~~for WirelessMAN-CX~~ in support of ~~license-exempt and uncoordinated bands~~ operation in *non-exclusively assigned* and *non-exclusively licensed* bands. Firstly, general concepts are described ~~which are general to the MAC, after which PHY specific interactions are considered. PHY specific discussion is required since WirelessMAN-CX operation is dependant on the features supported for a given PHY~~, after which details of support for *uncoordinated coexistence mechanisms* are presented. The mechanisms are related to bands containing *Specific Spectrum Users* and those containing *Secondary Users*. It shall be left to regulation to mandate such mechanisms for a particular band.

Delete subclause 6.4.1.3 – as the material is not referenced anywhere else.

Delete subclause 6.4.2 and all its subclauses except subclause 6.4.2.1, which should be retained under a new subclause number (6.4.3.1).

Create a new subclause 6.4.2 with title 'Uncoordinated coexistence mechanisms'.

Create a new subclause 6.4.2.1 'Introduction', and include the following text.

This subclause details a number of *uncoordinated coexistence mechanisms*.

The mechanism overviewed in subclause 6.4.2.2 is intended to protect *Specific Spectrum Users* (SSUs) where regulation mandates. Subclause 6.4.2.3 provides a general *uncoordinated coexistence mechanism* suitable, for example, in bands where no mandatory coexistence behavior is required. In a band such as this, with assignments made in a non-exclusive manner, a mechanism is required to ensure a system possess the ability to satisfactorily coexist with other wireless users (*Secondary Users*) also using the band. Subclause 6.4.2.4 provides an Uncoordinated Coexistence Protocol (UCP) to provide a further mechanism to allow operation in non-exclusively assigned and non-exclusively licensed bands.

In bands containing both SSUs and *Secondary Users*, it can be expected that a combination of schemes presented in this subclause will be required to provide mandatory protection for the SSUs and as well as a means of coexistence with *Secondary Users*.

Move subclause 6.3.15 to 6.4.2.2 and renumber accordingly. Change the title of 6.3.15 to 'Coexistence with specific spectrum users (SSUs)'.

Change all references in the base standard and Working Document accordingly.

Create the following at subclause 6.4.2.3.

6.4.2.3 Uncoordinated coexistence with *Secondary Users*

6.4.2.3.1 Introduction

This subclause considers *uncoordinated coexistence mechanisms* for use in bands where *secondary users* are present. The main distinction for *coexistence* with *secondary users*, when compared with SSUs (6.4.2.2), is that there are no regulatory demands placed on the solution, such as monitoring requirements, probability of detection requirements, or time to vacate the operating *frequency*. When a *secondary user* is detected it is not mandated that the operating *frequency* be vacated. One realization of *uncoordinated coexistence* with *secondary users* is Dynamic Channel Selection (DCS).

6.4.2.3.2 Dynamic Channel Selection (DCS)

Dynamic Channel Selection (DCS) is a realization of an *uncoordinated coexistence mechanism* and provides the ability for a system to switch to different *logical channel* based on channel measurements and thus avoiding interference in *non-exclusively assigned* bands. *Logical channels* can be constructed from an operating *frequency* and time component, or a portion thereof. Channel measurement and interference avoidance provide a DCS algorithm with the means of obtaining interference isolation in time and frequency. This approach enables a number of systems to share a given *frequency*. The approach contrasts to that of subclause 6.4.2.2, which specifies SSUs avoidance in which the physical *frequency* is vacated due to the potential interference to the SSU.

Measurement periods are scheduled by the BS via the DL-MAP and the UL-MAP for the BS and SS respectively. Division of the operating *frequency* into effective time slots provides interference isolation in time and subchannelisation and changes to the operating *frequency* provides frequency isolation. The divisions in time and frequency, and therefore the creation of *logical channels*, are left to the implementer's discretion.

Mechanisms are supported with the REP-REQ/ REP-RSP (6.3.2.3.33) MAC messages to provide reports of interference and therefore *logical channel* usability. Once a logical channel unusable due to prevailing interference that has surpassed a predetermined threshold or degraded the BER sufficiently, the BS may chose to move to a new *logical channel*. This new *logical channel* may be unmeasured or a member of a backup list of available *logical channels* previously measured by the BS. Depending on the prevailing air interface resources, the number of backup *logical channels* may vary. Also the 'freshness' (in terms of when they were measured and how accurate the measurements is likely to be) may depend on available resources to accomplish this task. In the same way the interfered *logical channel* previously vacated may be monitored for usability after some defined period. Figure h1 (subclause 6.4.2.2), although specifically for SSUs, provides an example of how DCS can be used to provide resource management and backup operating channels.

A general example of a DCS solution is provided in figure xyz1 in which interference detection provides agility in frequency and time to reduce the affects of the incident interference.

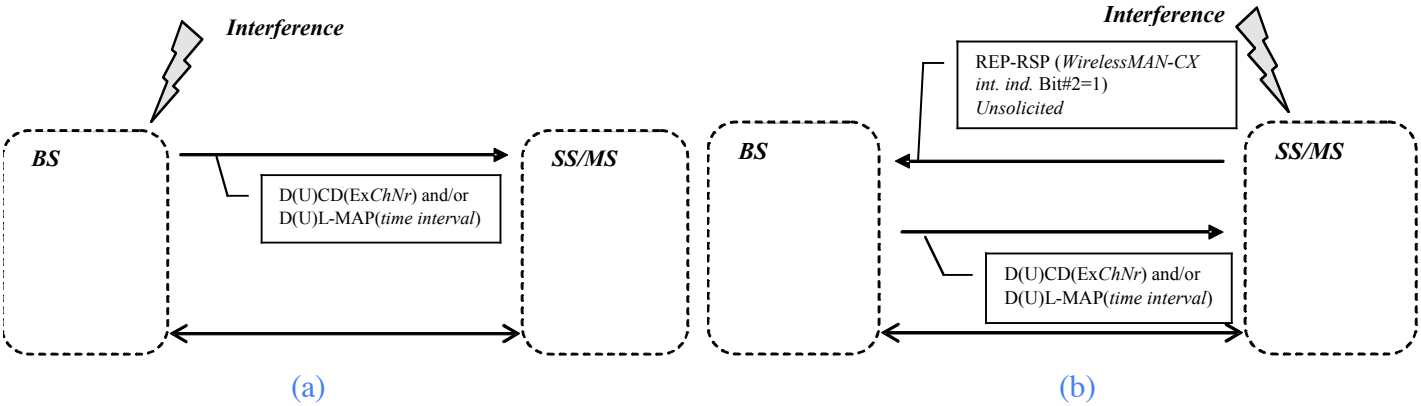

Figure xyz1 *Link level representation of DCS operation: (a) interference and remedial action at the BS, (b) interference reporting and remedial action at the MS/SS.*

Delete subclause 6.4.3 and its subclauses.

Create a new subclause 6.4.3 'Support for WirelessMAN-CX'. Move subclause 6.4.2.1 to a new subclause 6.4.3.1.

Add the following subclause titles with reference to [5] for the specific text in each of the subclauses.

6.4.2.4 Uncoordinated Coexistence Protocol (UCP)

6.4.3.2 Enhanced measurement and reporting for non-exclusively assigned or licensed bands

6.4.3.3 Extended quiet period (EQP)

6.4.3.4 Adaptive EQPs

6.4.3.5 Listen-before-talk

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Make the following modification to Clause 15:

Change the title of Clause 15 from 'Mechanism for improved coexistence' to 'Coordinated coexistence mechanisms'.

Make the following changes to subclause 15.1 'General'.

This clause describes high-level protocols and policies to be used for coordinating the system operation in order to reduce the inter-system interference. All features in this clause, which specifies the WirelessMAN-CX operation, fall under the class of *coordinated coexistence mechanisms*. The features are not mandatory for the implementation of the standard except as specified by applicable regulation.

Replace all instance of 'collaborative' with 'coordinated' and all instances of 'non-collaborative' with 'uncoordinated'.

~ ~ ~

Add the following definitions, in the correct position respecting alphabetic ordering, to Clause 3: 'Definitions'.

3.xx **Centralized coexistence mechanism**: A mechanism by which radio transmission systems share spectrum, using site planning and transmissions scheduled under the control of a main entity.

3.xx **Centrally controlled radio system**: One or radios whose transmissions are under the control of a central entity. Note: In the IEEE Std 802.16 point-to-multipoint specification, radios operated only as part of a centrally controlled radio system.

3.xx **Coordinated coexistence mechanism**: A coexistence mechanism relying on exchange of protocol-based messages among radios or centrally controlled radio system.

3.xx **Uncoordinated coexistence mechanism**: A mechanism by which a radio, or centrally controlled radio system, attempts to achieve coexistence without exchanging messages with other spectrum users.

3.xx **Sensing-based coexistence mechanism**: An uncoordinated coexistence mechanism using channel state determination by means of sensing energy in the channel.

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Other editorial changes

- ***Global replace in preference to 'coordinated coexistence mechanisms' and 'uncoordinated coexistence mechanisms'.***

References

[1] IEEE 802.16h-06/015r1: *Air Interface for Fixed Broadband Wireless Access Systems: Amendment for Improved Coexistence Mechanisms for License-Exempt Operation*, Working Document.

[2] IEEE 802.16h-06/012r1: *Comments received in Working Group Review of Working Document IEEE 802.16h-06/010.*

[3] IEEE C802.16h-06/072: *Proposed P802.16h terminology definitions*, Paul Piggin.

[4] IEEE C802.16h-06/073: *Specification of operational environments for non-exclusively assigned and licensed bands*, Paul Piggin, Ken Stanwood.

[5] IEEE C802.16h-06/074: *Uncoordinated Coexistence Protocol (UCP)*, Paul Piggin, Lei Wang, and Ken Stanwood.