Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Using Radio Signature in the CX_CC Channel and other Changes to Section 15.4.2.1.2**
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Re:	Changes to Draft Stanadard
Abstract	Changes to Section 15.4.2.1.2 of Draft Standard (October 2006 Version)
Purpose	Consolidate Radio Signature and CX_CC concepts; make editorial changes.
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Using Radio Signature in the CX_CC channel and other Changes to Section 15.4.2.1.2

By
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Introduction

Section 15.4.2.1.2 discusses the mechanisms that are used to schedule interference free intervals. Three techniques that are defined in this section; the techniques being Sub-Frame scheduling, Radio Signature Scheduling, and Definition of a Coexistence Zone within a Sub-Frame.

As a proposal, it is recommended that this section be divided into 3 sub-sections (see proposed text changes below).

Discussion

Section 15.4.2.1.2

This section currently outlines the partitioning of the Common/Master/Slave sub-frames
(with some formula labeling errors) and it establishes the maximum number of systems that can exist on a co-channel basis (Nmax=3). This in general, is aligned with the Draft Document so few changes are required. The only major change being that Nmax=6 will be identified as an option for future consideration.

Section 15.4.2.1.3 (New)

It is proposed that the discussion on Radio Signatures be given a new sub-section.
Furthermore changes are requested to put this section's discussion in line with the current CX_CC concept.

The discussion concerning the use of the Radio Signature operation and allocation of Radio Signature slots within the framing structure (shown in Figure h42 current document), is not fully explained and when examined in detail, may not be sufficient to support its intended operation. Examples are given below.

In the current Section 15.4.2.1.2, lines 29 Page 90 to Line 6 Page 92, discusses the use of Radio Signature to measure interference created by a transmitter. As such, Radio Signature signals are to be sent by a transmitter during its Master Frame. These are intended for measurement by other systems. Other frames (slave frames) of interference neighbors, use a Gap interval to create a quiet period allowing the Radio Signature to not be affected by neighboring interference.

The problem with this scheme is that the position of the Radio Signature Interval is variable. Stipulation of the Radio Signature Interval parameters, such as its length, location in the frame, offset , repetition rate, etc. are settable parameters (Table h13) that can vary from community to community. This is problematic because communities have the possibility of being adjacent and interfering with each other. The setting of different parameters between communities negates the ability of systems to determine interference and identify it.

This section also lacks detail on what processes BS will use to ensure that Radio Signatures do not interfere with each other, if the parameters are set the same. There is also no mechanism for example, to resolve two

Radio Signatures that exist on the same interval. Since Radio Signatures are tied specifically to the Master Frames positions, there is no guarantee that two or more adjacent communities will follow that same formatting or positioning of their Master frames. Some communities may have 2 members, others may have 3. If these communities are adjacent, even if they have the same Radio Signature parameters, they will interfere with each if there framing is offset. This section has not been updated to consider the benefits realized from Universal Timing Synchronization.

The intent of the Radio Signature, as discussed in Section 15.4.2.1.2 has largely been superceded by the use of the Coexistence Control Channel (CX_CC) . This channel provides a simple technique for distribution Radio Signature information. For example:

- Specific intervals, such as CMI, are provided for a system to claim, and use for continually thereafter for advertising the presence of its BS and SS. These intervals are interference free and only used for sensing and signaling of interference phenomena. CMI intervals cannot be corrupted by data emanating from adjacent communities, as is possible currently with Radio Signatures.
- The intervals are synchronized to a Universal Timing Standard allowing all entering IBS as well as OBS to know exactly when to look for Radio Signature information, without relying on look-up table or lists of parameters.
- There is a technique for resolving the presence of multiple Radio Signatures on a CMI, that will guarantee, within time, resolution of multiple occupants.
- The CX_XX provides universally known quiet zones for the whole Wireless MAN-CX community; a feature not provided with the current Radio Signature concept, but important for interference detection.

Blue text represents specific editorial changes
~~Red strikethough~~ text is to be deleted
Black text is text already in the draft
Bold italic text is editorial instruction to the editor

Currently we are considering 3 Co-Channel networks and optionally, up to 6 Co-Channel networks to coexist; this should be reflected in this section; specifically at lines:

and the repetition interval RI equals to either N*TMAC or (N+1)*TMAC. In the last case the repetitive sequence starts with a Common MAC Frame.

N_{MAX} = 3 (mandatory; optionally can be 6)

Need consistency with formulas and drawings of previous page:

where:

18
19 -T_{MAC}, T_{TxMAC}, T_{RxMAC}, T_{TxC} are the durations of the respectively the MAC frame,
20 Tx interval and Rx interval of the MAC frame and Common Frame;
21
22 -~~T_{Txsh}, T_{Rxsh}~~ $T_{Tx\_subframe}$, $T_{Rx\_subframe}$ are the durations of the shared sub-frames. In the 23 above relations, the meaning of Tx or Rx is relative to the usage of the MAC Frame by a Base Station.

Starting at Line 30 on Page 90 of the current Draft document the following changes are needed.

15.4.2.1.3 Radio Signature use and the CX_CC

During some of the ~~Master~~ sub-frames of the Down Link Channel, and in accordance to the numbering and timing schemes for the Coexistence Control Channel (CX_CC see Section 10.5.3) ~~and in the~~ the Base Station ~~will create a slot, possibly not overlapping with another slot of a coexistence neighbor Base Station, during which every transmitter (BS or associated SS)~~ will send a predefined signal~~; this signal,~~ called a "radio signature". This will appear in the CMI or other interference control slots of the CX_CC, and will be used to measure the interference created by that transmitter to other systems. Details of the CX_CC are given in Table 345d and in Section 15.1.5.3.1. CMI-type radio signatures are used with same-PHY profile Wireless MAN-CX systems; Frequency-Keyed and other types of radio signatures are used for different-PHY profile systems.
Details of CMI radio signatures are given in Section 15.1.4.1.2 and Energy Keyed signatures in Section 15.4.3.4
— The ~~"~~radio signature ~~slot"~~ for a Base Station will be created during its Tx ~~Master~~ downlink sub-frame, ~~every B MAC-frames~~; and sent in the CMI interval or other interference control slots of the CX_CC.
— The ~~"~~radio signature ~~slot"~~ for a Subscriber Station will be created during the ~~Rx Master~~ uplink sub-frame; and sent in the CMI interval or other interference control slots of the CX_CC.
— ~~UL MAP and suitable UIUC for scheduling the "radio signature" are t.b.d.~~
— During the CX_CC and during the transmission of a ~~"~~radio signature~~"~~ ~~intervals~~ , all the other BSs and SSs not associated with the system creating the radio signature shall ~~shall use a GAP interval, during which no transmission is to be made;~~cease transmissions.
— The Base Station shall provide enough transmit opportunities for the active SSs, on the uplink by scheduling the SS radio signature in accordance with the UL-MAP sent during the downlink .
Figure h 42 shows the ~~possible~~ allocation of the ~~"~~radio signature~~"~~ transmission opportunity using CMI and and the CX_CC ~~for a given system~~, using for example the Type 1 repetitive sub-framing pattern~~, with a focus on system 2.~~ The scheme is equally applicable to Type 2 patterns as well~~.~~

~~The system 2 will transmit it's~~ A Base Station transmits radio signatures in the CX_CC channel; ~~from time to time (every N MAC intervals);~~ different radio signatures will be sent for every used power/sub-channelization/OFDMA sub-channel/ spatial direction combination. During these intervals the other Base Stations will only receive ~~schedule a GAP interval~~, in order to identify one Base Station solely. Base Stations located in different Coexistence Communities but using the same CMI or other interference control slots will have techniques for resolving such conflicts, as for example detailed in Section 15.3.2.1 ~~MAC sub-frame as the Master sub-frames shall schedule the transmission of their "radio-signatures" in such a way that they will not interfere with each other~~.

~~The transmission of "radio-signatures" used by the active SSs will take place during the Master sub-frame, from time to time (a timer shall be defined). The repetition period and the duration of the signature transmissionshall be a parameter in the BS Database. The active SSs will provide a signature for every used power/OFDMA/sub-channelization/ direction setting~~.

Delete Current Figure h42 and replace it with the following new figure.

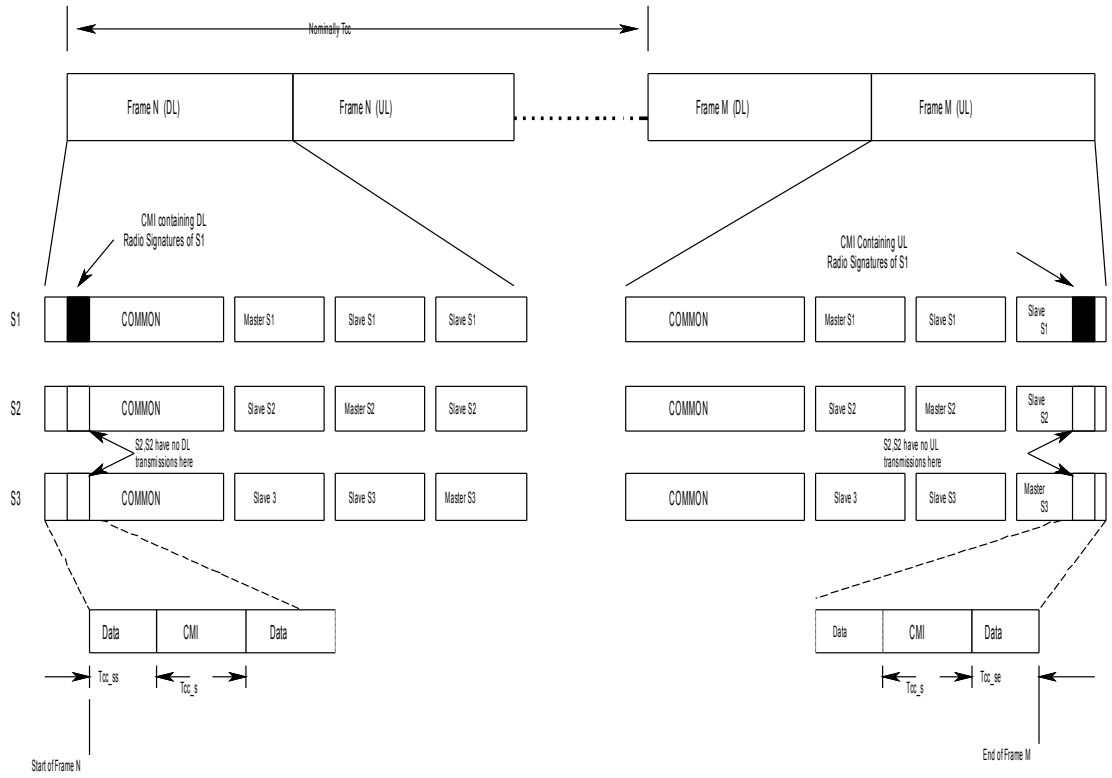

Figure h42 - Distribution of CMI for BS and SS Radio Signature Applications

Delete lines 28 Page 91 to line 6 of Page 92 of the current draft document

On Line 7 of Page 92 insert the following new title to the discussion given between Line 8 of Page 92 and Line 3 of Page 93.

15.4.2.1.4 Scheduling of Coexistence Zones In Sub-Frames