Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	Consolidation proposal according to 4 frame structure	
Date Submitted	**2007-05-09**	
Source(s)	Wu Xuyong, Huawei	Voice: +86-755-28973547 Fax: wuxuyong@huawei.com，
Re:	IEEE 802.16-07/010：IEEE 802.16 Working Group Letter Ballot Recirc #24a: Announcement (2007-02-01)	
Abstract	According to 4 frame structure, some compliant consolidation should be made within CSI scheduling and the subframe reallocation mechanisms.	
Purpose	To consolidate the 16h draft.	
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Consolidation proposal according to 4 frame structure

Wu Xuyong

Overview

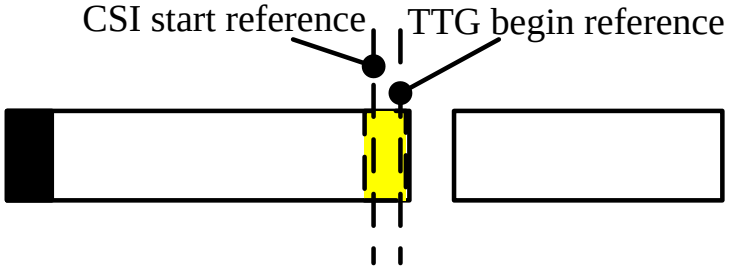
We have some discussion in meeting 48 about the allocation map about the CSI, according to comment 2096 and 2098 by Kenneth Stanwood:
Comment 2096:(awaiting resolution)
Page 80, Line 44, Subclause 15.3.1.1.1, Document P802.16h-D2
Comment: The allocation map is just information the BTS needs to maintain internally based on who transmits in which CMI or CSI. We shouldn't spec it in the standard.
Suggested Remedy: Delete at least from page 80, line 44 through page 81, line 43, maybe more.
Reply by Wu Xuyong: We need to rewrite this part according to fix frame structure assumption. It will be much more simplified in case the master system use the according coexistence interval, and may not necessary to seperate section for scheduling.
Let's move.
Group Decision: Accept-Modified
Group Resolution: AI taken by Xuyong to provide the text changes to revise the description of the allocation of CSI, according to the result of the Adhoc of CSI/CMI/CXCC.

Comment 2098: (already done in D2a)
Page 87, Line 38, Subclause 15.3.1.3, Document P802.16h-D2
Comment: The allocation map is just internally stored information and should not be spec'd..
Suggested Remedy: Delete the last sentence of the paragraph..
Reply by Wu Xuyong: see contribution C80216h-06_114r3.
Group Decision: Accept-Modified
Group Resolution: Delete "By recognizing the OCSI allocation map (See 15.3.1.1.1),"

While with the approach of fix 4 frame structure within the co-channel coexistence, the original allocation map of the CSI usage should be updated accordingly. And here is some necessary updating related. Pls see the slide S80216h-07_054 for case study examples.

CSI timing parameter refining:

Firstly, since the CSI timing is according to the current frame structure related to TTG, we need to finalize some timing parameter so that every system should be aware about the CSI effective time. So we define 2 new reference time points to ensure every system can use the CSI time within the same time position and duration.



1) TTG beginning reference time:
TTG shall start with the first symbol/PS start not earlier than this point;

It can be put in the middle of the frame or with some other unique DL/UL ratio within one band. This is necessary for the TTG allocation for synchronization of the TTG; it will help to eliminate DL/UL cross interference between neighbor system either in co-channel or adjacent channel.
For CSI timing, this reference is used for:
CSI shall end up with the last symbol/PS end not earlier than this point;
2) CSI start reference time: CSI shall start with the last symbol/PS start not later than this point.

CSI Scheduling Updating:

Now let's see the current frame structure according to 4 frame assumption.
For the 4 Frames which have CSI, the structure is shown below, while the abbreviation are SH-share; M1/2/3-Master1/2/3; DL/UL-Downlink/Uplink:

Figure1a: 4 Frame structure with CSI

For the 4 Frames which do not have CSI, (In these frames, using the parameter defined within the OCSI cycles, these CSI interval is dummy to allow the normal data transmition.) The structure for such 4-frame is shown below:

Figure1b: Frame structure with dummy CSI

Now let's considering some basic scenario of the usage of the 4-frame structure:
1) 1 system (S1) start in a blank area, it can occupy all the 4 frame for data usage but it can choose one of the OCSI for the active interference identification for its potential neighbor. Notice, the OCSI is always going with the master frame it chooses to use; the rest part of the frame is ready to abandon the usage on the request of neighbor.
2) When a neighbor system (S2) comes, after negotiate with S1, it chooses M2 as its master and interleaves the last frame occupation with S1.
3) When the 3rd system comes to join the party, all the 3 system can use only there Master resource and the OCSI. See below.

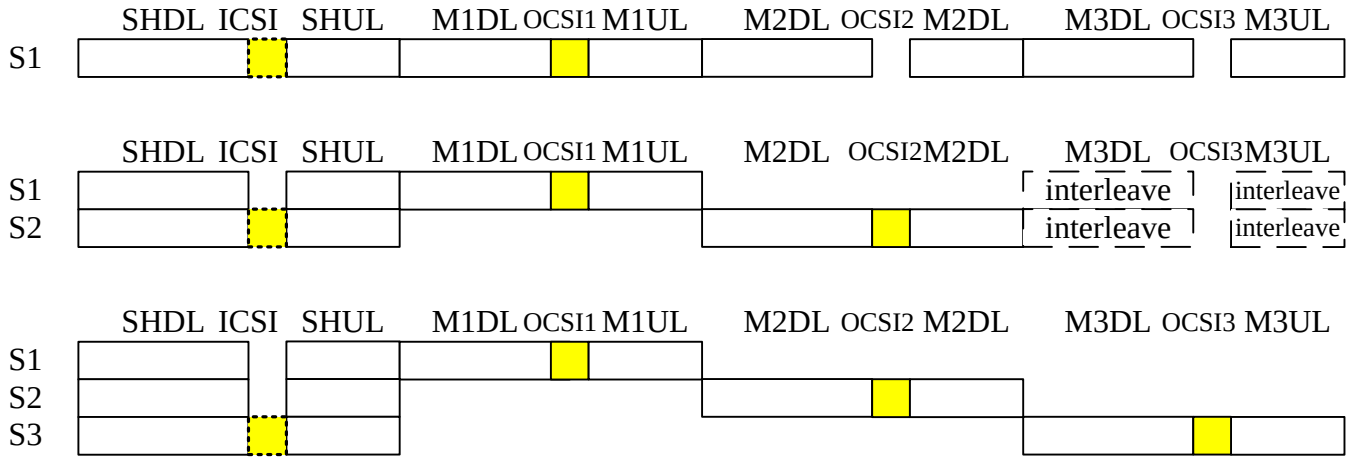


Figure2a: example for neighborhood frame and CSI occupation for 4frame structure

The rest 4-frames without CSI timing reservation is also periodically assigned by the same scheme as above. See below:

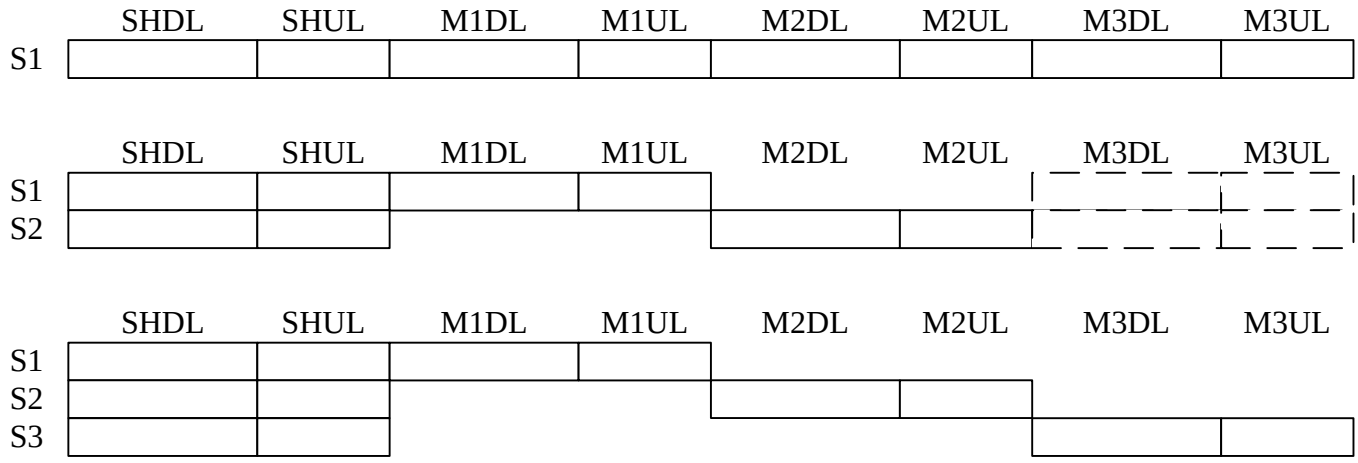


Figure2a: example for neighborhood frame occupation in 4frame structure

If we symbolize the figure above, we can see the scheme for frame assignment and the CSI assignment for each cycle of frame occupation and CSI allocation accordingly.

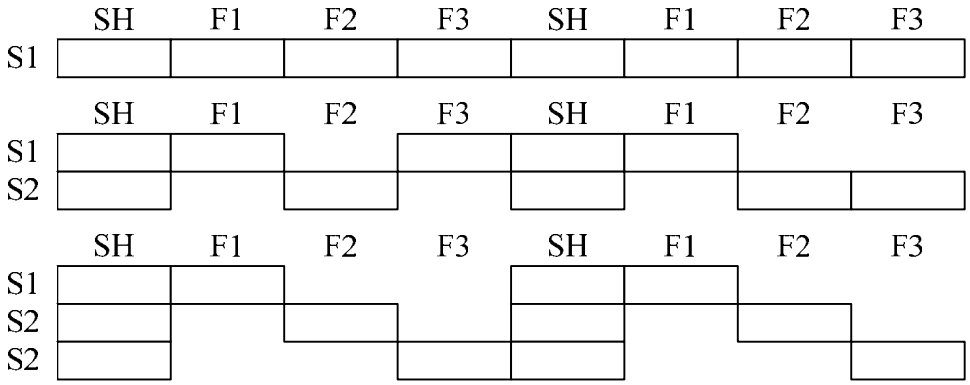


Figure 3a: example for 8 data frames allocation cycling for 4frame structure

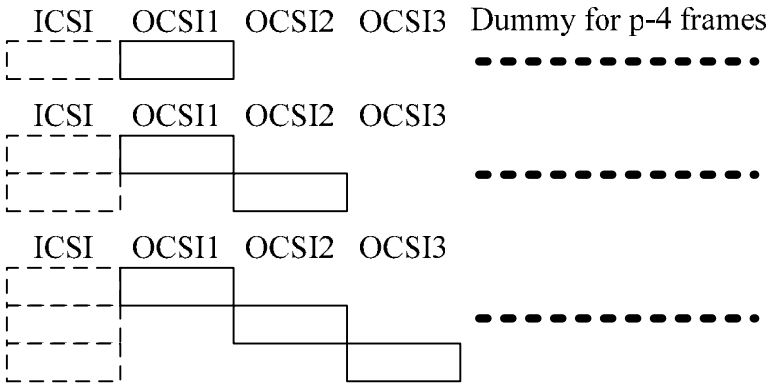


Figure 3b: example for CSI allocation cycling for 4frame structure

Reference:

[1] *IEEE 802.16-07/016r4: comment database of IEEE 802.16 LB24a (2007-04-12)*

[2] *IEEE P802.16h/D2a: (Temporary Editor's Draft) D2a for P802.16h (2007-03-28)*

[3] *IEEE 802.16-07/010：IEEE 802.16 Working Group Letter Ballot Recirc #24a: Announcement (2007-02-01)*

[4] *IEEE 802.16-2004: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems (2004-10-01)*

[5] *IEEE 802.16e-2005: IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands and Corrigendum 1 (2006-02-28)*

[6] *IEEE C802.16-07/020r1:* Action Items from Session #47 (Mariana Goldhamer; 2007-03-23)

[7] *IEEE C802.16h-07/082: Using energy pulses for interference identification between 802.16 systems. (Wu Xuyong; 2006-09-17)*

[8] *Calculating the Sensitivity of an ASK Receiver (MAXIM APPLICATION NOTE 2815 2003-11-05)*

[9] *IEEE C802.16h-06/054 Discussion on implementing the energy pulse (Wu Xuyong 2006-07-10)*

Proposed Changes accordingly:

15.1.4.1.1 and 15.3.1.1.1 should be modified according to the concept above.

15.3.1.1.3 Energy keying in time domain

The information carried in the CSI slots shall be broadcast by the BS and received by the SSs in a coexistence neighbor system. The modulation technology of the interference source and victim system should be one of the following: SCa, OFDM or OFDMA, and may be different between the interference source system and interference victim system.

The information unit in the CSI slot is bit, carried by the timing of transmission in CSI. The duration of the CSI length is counted by symbols or PS according to the technology that the system is using. The CSI shall be located right before the TTG Gap, and at the end of the last downlink burst send by BS. The BS shall set the transmission timing parameter (see *10.5.4*) according to the bit value that it is sending. And the SS in victim system is monitoring the signal strength in CSI duration to get each bit value within the CSI sequence (see *15.3.1.1.2*).

For the transmission side (BS), to use CSI duration as part of the data burst and ~~continues to~~ stop transmition at or later than $T_{CSIEREF}$ (*10.5.4*) indicates bit one, while to stop transmission at ~~the beginning of CSI duration~~ or before $T_{CSISREF}$ (*10.5.4*) indicates bit zero. (See *Figure h37* . below) While the receiver side is using the signal strength during the CSI duration to decode the carried bit, in periodical CSI slots allocated for each transmitter, the receiver is de facto demodulate energy keying or so called on/off keying signal. The detail of the receiving algorithm is out of the scope of this standard.

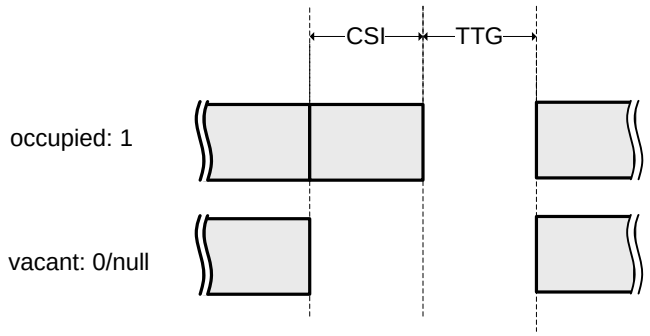


Figure h37- Timing of CSI bit unit

Modify the text below in primary standard accordingly:

10.5.4 CSI timing parameters

Add 2 rows and change the table 345e first 2 rows as indicate:

Table-345e CSI timing parameter

System	Name	Time reference	Minimum value	Default value	Maximum value
BS,SS	$T_{CSIEREF}$	CSI end reference time, as an offset from the starting point of the synchronized frame. CSI duration shall end up with the last symbol/PS at or later than this timing reference; While TTG start with the first symbol/PS at or later than this timing reference; This time parameter shall be specified according to each band regionally where the CSI feather is used.		0.6 frame duration	
BS,SS	$T_{CSISREF}$	CSI start reference time, as an offset value from the starting point of the synchronized frame. CSI shall start with the last symbol/PS at or earlier than this point.		$T_{TTGSREF}$ -100us	
BS/SS	Tcsi_start	Starting point of the CSI in each frame (**Error! Reference source not found.**), which is counted in PSs/symbols according to $T_{CSIEREF}$ requirement			
BS/SS	CSI duration	Time duration of each CSI interval (**Error! Reference source not found.**), which is counted in PSs/symbols	1ps/1symbol		

		according to $T_{CSISREF}$ requirement			