Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
Title	Scheduling idle gaps for SSs to perform ~~non-working~~ channel measurements
Date Submitted	2007-05-10
Source(s)	Shulan Feng Hisilicon Tech. Co., LTD Bld.17, No.8, Dongbeiwang West Road, Hai-Dian District, Beijing, P. R. China	Voice: +86-10-82829151 Fax: +86-10-82829075 e-mail to : fengsl@hisilicon.com , fengsl@huawei.com
Re:	IEEE 802.16 Working Group Letter Ballot #24a, on P802.16h/D2
Abstract	This contribution proposes to schedule periodic idle gaps for SSs to perform non-working channel measurements.
Purpose	To schedule periodic idle gaps for SS so that it can perform non-working channel measurements without affecting normal traffic between SS and serving BS.
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) 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 and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

Scheduling Idle Gaps for SSs to Perform ~~non-working~~ Channel Measurements

Shulan Feng
HiSilicon Technologies Co., LTD

Introduction

Channel measurements are very important for LE systems. To get better frequency efficiency and avoid interference, system must perform correct and timely channel measurements. BS is responsible for scheduling measurement periods for SSs. In current working group draft[1], for UCP, measurement periods are transmitted to SS via channel measurement IEs (8.4.5.3.5) or EQP IEs (8.4.5.3.29). Channel measurement IE schedules SS to perform channel measurement in current frame and EQP IEs schedules SS to perform channel measurement during EQPs.

Channel measurement IE specifies the measurement ~~zone~~interval in only one frame. For each time BS wants SSs to perform channel measurement, it will send the MAC massage to SS. In some cases, BS may require SS to monitor continuously one channel. Using current channel measurement IEs may increase the overhead.

On the other hand, how the measurement periods are scheduled and transmitted has not been defined for coordinated coexistence protocol. For coexistence protocol, BS may request SS to perform channel measurement during slave sub-frame or CSI/CMI/CXCC slot. Slave sub-frame pattern and CSI/CMI/CXCC pattern are periodic and this makes periodic measurement ~~zone~~interval more suitable.

Finally, interference status in different sub-frame may different, so BS may schedule more than one measurement pattern for each SS and send more than one measurement request to SS. Measurement reports of SS should indicate corresponding measurement patterns.

Proposed Scheme

We propose that BS schedules periodic measurement ~~zone~~intervals for SS to perform channel measurement. During scheduled measurement ~~zone~~interval, BS shall not transmit MAC PDUs to that SS or request any uplink transmission from SS. BS should schedule measurement ~~zone~~interval properly so that no effect on normal traffic transmission between BS and SS.

Upon receiving a measurement requirement, SS shall start to measure the indicated channel during the scheduled measurement ~~zone~~intervals. SS shall continue to measure the indicated channel during the scheduled measurement ~~zone~~intervals until the measurement interval ends or serving BS schedules SS to receive and/or send signal during measurement ~~zone~~interval.

If the SS is requested to perform measurement in non-working channel, SS shall start to measure the indicated channel no later than **Max. Channel Switch Time** after the start of measurement ~~zone~~interval and stop the measurement no later than **Max. Channel Switch Time** before the end of measurement ~~zone~~interval.

BS may schedule more than one measurement pattern for one SS. Measurement ~~zone~~interval of different measurement pattern shall not be overlapped.

A measurement pattern includes parameters listed below.

Start Measurement Frame Offset: The frame offset of first measurement frame number to the frame

containing the channel measurement IE message.

Number of Frames between two measurement ~~zone~~intervals: Number of Frames between two continuous measurement ~~zone~~intervals.

Start of Measurement ~~Zone~~Interval: the OFDMA offset between the start of measurement ~~zone~~interval and the frame header.

End of Measurement ~~Zone~~Interval: the OFDMA offset between the end of measurement ~~zone~~interval and the frame header.

Number of Frames for Periodic Measurement ~~Interval~~: the total number of frame which contains the periodic measurement pattern.

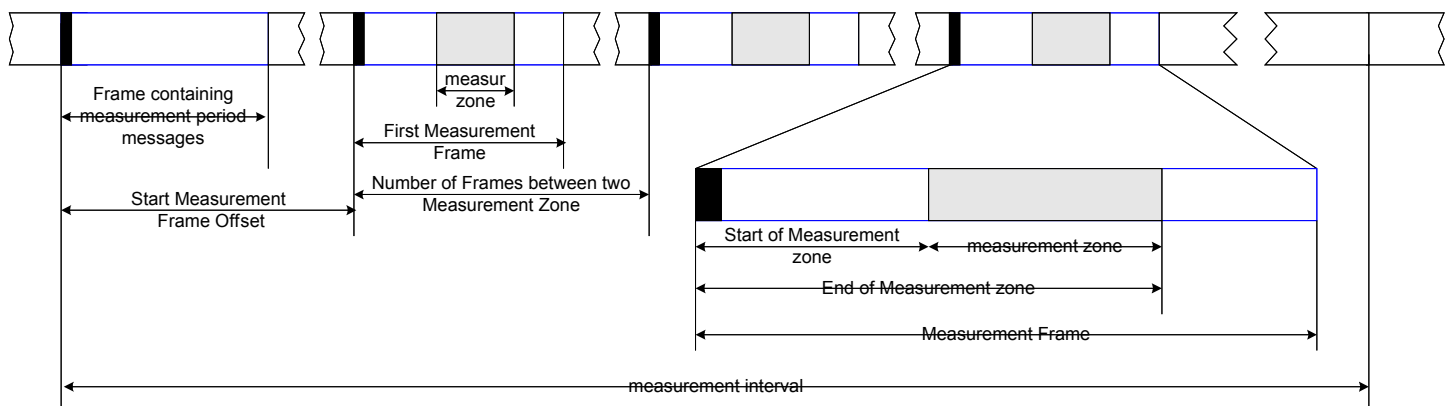Figure below gives an example of the measurement pattern.

Figure 1 measurement pattern

BS may schedule more than one measurement patterns for each SS for different purpose. Measurement reports of SS should indicate corresponding measurement patterns.

Examples

In this section, we give some examples of the measurement pattern parameters setting.

If we want SS to perform measurement during periodic quiet frame, we may set corresponding parameters as below:

Start Measurement Frame Offset: 0

Number of Frames between two measurement ~~zone~~intervals: 4

Start of Measurement ~~Zone~~Interval: 0

End of Measurement ~~Zone~~Interval: frame length in OFDMA symbol

If we want SS of system 1 to perform measurement during slave sub-frame of second CX-Frame in the figure h46 of draft 2, we may set corresponding parameter as below:

Start Measurement Frame Offset: 0

Number of Frames between two measurement ~~zone~~intervals: 4

3

Start of Measurement ~~Zone~~Interval: the OFDMA offset between the start of slave sub-frame and the frame header.

End of Measurement ~~Zone~~Interval: the OFDMA offset between the end of slave sub-frame and the frame header.

If we want SS to perform measurement during CSI slot, we may set corresponding parameter as below:

Start Measurement Frame Offset: 0

Number of Frames between two measurement ~~zone~~intervals: 1

Start of Measurement ~~Zone~~Interval: the OFDMA offset between the start of CSI slot, including necessary channel switch time and the frame header.

End of Measurement ~~Zone~~Interval: the OFDMA offset between the end of CSI slot, including necessary channel switch time and the frame header.

Proposed Text
8.3 WirelessMAN-OFDM PHY

[Add a new section at the end of 8.3.6.2.10]

8.3.6.2.~~10~~11 Periodic~~Enhanced~~ Channel Measurement IE

An extended IE with an extended DIUC value of 0x08 is issued by the BS to request periodic channel measurement ~~report~~ (see 15.1.3.2.1).

Table 224c OFDM ~~Enhanced~~ Periodic channel Measurement IE

Syntax	Size	Notes
~~Enhanced~~Periodic_Channel_Measurement_IE() {		
Extended DIUC	4bits	CHM=0x08
Length	4bits	Length=0x04
Extended Channel Nr	~~8bits~~16bits	Extended Channel Number (see ~~88.5.1~~5.1.2) ~~Set to zero for license bands~~
CID		Basic CID of the SS for which the channel measurement IE is directed.
Number of Measurement Request	4bits	n
For(i=0;i<n;i++) {		
Measurement request index	4bits	
Number of Frames for Periodic Measurement~~Number of Frames of Measurement~~	16bits	the total number of frames to perform periodic measurement 0: indicate the periodic measurement ~~interval is unlimited~~will continue all the time ~~In unit Frame~~

Start Frame Number Offset	8bits	The offset of frame which start measurement to the current frame
Number of Frames between two Measurement ZonesIntervals	8bits	Number of frames between two available measurement frames
Start of Measurement ZoneInterval	8bits	OFDMA offset of the beginning of measurement zoneinterval
End of Measurement ZoneInterval	8bits	OFDMA offset of the end of measurement zoneinterval
}		
}		

8.4 WirelessMAN-OFDMA PHY
8.4.5.3.2.1 DL-MAP extended IE format
[*Insert the following rows to table 277a*]

Table 227a defines the encoding for extended DIUC that shall be used by DL-MAP extended IEs.

Table 270a Extended DIUC Code Assignments for DIUC=15

Extended DIUC (hexadecimal)	Usage
00	Channel_Measurement_IE
01	STC_Zone_IE
02	AAS_DL_IE
03	Data_location_in_another_BS_IE
04	CID_Switch_IE
05	MIMO_DL_Basic_IE
06	MIMO_DL_Enhenced_IE
07	HARQ_Map_Pointer_IE
08	PHYMOD_DL_IE
09~0A	Reserved CXZ_DL_IE
0A	EQP_IE
0B	DL PUSC Burst Allocation in Other Segment
0C	Extended_Channel_Measurement_IE
0D	EnhancedPeriodic_Channel_Measurement_IE
0E	Reserved
0F	UL_interference_and_noise_level_IE

[*Add a new section at the end of 8.4.5.3.3231*]

8.4.5.3.32 EnhancedPeriodic_Channel Measurement IE
An extended IE with an extended DIUC value of 0x0D is issued by the BS to request periodic channel measurement report (see 15.1.3.2.16.3.15).

Table 280 286ae OFDMA Periodic channel Measurement IE

Syntax	Size	Notes
EnhancedPeriodic_Channel_Measurement_IE() {		
Extended DIUC	4bits	CHM=0x0D
Length	4bits	Length=0x04
Extended Channel Nr	8bits16bits	Extended Channel Number (see 8.5.1.2) (see 8.5.1) Set to zero for license bands
CID		Basic CID of the SS for which the channel measurement IE is directed.
Number of Measurement Request	4bits	n
For(i=0;i<n;i++) {		
Measurement request index	4bits	
Number of Frames for Periodic MeasurementMeasurement Interval	16bits	the total number of frames to perform periodic measurement 0: indicate the periodic measurement will continue all the time.interval is unlimited In unit Frame
Start Frame Number Offset	8bits	The offset of frame which start measurement to the current frame
Number of Frames between two Measurement ZonesIntervals	8bits	Number of frames between two available measurement frames
Start of Measurement IntervalZone	8bits	OFDMA offset of the beginning of measurement intervalzone
End of Measurement IntervalZone	8bits	OFDMA offset of the end of measurement intervalzone
}		
}		

11.11 REP-REQ management message encodings

[Insert the following entry in the second table of 11.11]:

Measurement Request Index	1.12	1	The measurement request index corresponding to report requested.

11.12 REP-RSP management message encodings

[Insert the following entry in the second table of 11.12]:

all	Measurement Request Index	1.7	1	The measurement request index corresponding to report requested.

[Add a new section at the end of section 15.1.3.2]

15.1.3.2.1 Channel Measurement in the Operating Stage

BS may request SS to measure one or more channels on its behalf in the operating stage. BS should schedule available measurement ~~zone~~interval for SS via ~~enhanced~~periodic_channel_measurement_IE (8.4.5.3.5). During scheduled measurement ~~zone~~interval, BS shall not transmit MAC PDUs to that SS or request any uplink transmission from SSs. BS should schedule measurement ~~zone~~interval properly so that no effect on normal traffic transmission between BS and SS.

Upon receiving a measurement requirement, SS shall start to measure the indicated channel during the scheduled measurement ~~zone~~intervals. SS shall continue to measure the indicated channel during the scheduled measurement ~~zone~~intervals until the measurement interval ends or serving BS schedules SS to receive and/or send signal during measurement ~~zone~~interval.

~~If the SS is requested to perform measurement in non-working channel, SS shall start to measure the indicated channel no later than **Max. Channel Switch Time** after the start of measurement zone and stop the measurement no later than **Max. Channel Switch Time** before the end of measurement zone.~~

BS may schedule one or more measurement pattern for SS. Measurement ~~zone~~interval of different measurement pattern shall not be overlapped. Measurement patterns are identified by measurement_request_index parameter in ~~enhanced~~periodic_channel_measurement_IE. SS should report measurement result corresponding to each measurement request from BS.

Conclusion

It is necessary for BS to schedule measurement ~~zone~~interval for SS to perform measurement. The periodic measurement ~~zone~~interval can decrease the signaling overhead and can be used to both UCP and CP. We suggest TG to consider the proposed periodic measurement ~~zone~~interval concept and accept the proposed text.

Reference

[1] IEEE 802.16h-D2: Air Interface for Fixed Broadband Wireless Access Systems: Amendment for Improved Coexistence Mechanisms for License-Exempt Operation
[2] IEEE 802.16-2004: Air Interface for Fixed Broadband Wireless Access Systems
[3] IEEE 802.16-2005: Air Interface for Fixed Broadband Wireless Access Systems: Amendment 2: Physical Media Access Control Layers for combined fixed and mobile operation in license band