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

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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~~interval~~s~~: Number of Frames between two continuous measurement ~~zone~~interval~~s~~.

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.

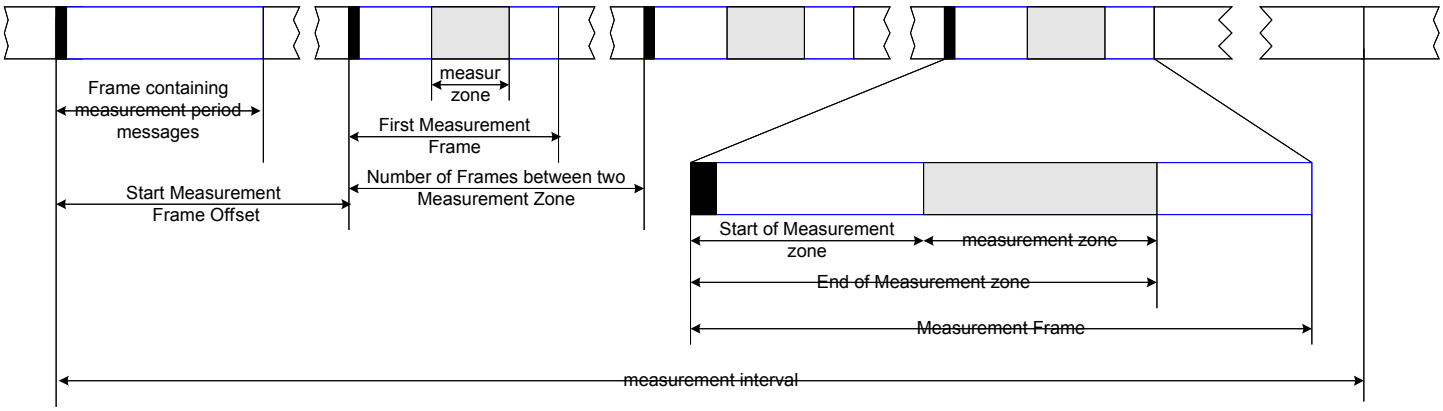

Figure 1 measurement pattern

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~~interval~~s~~: 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~~interval~~s~~: 4

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 ~~8.5.1~~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 ~~Zones~~Intervals	8bits	Number of frames between two available measurement frames
Start of Measurement ~~Zone~~Interval	8bits	OFDMA offset of the beginning of measurement ~~zone~~interval
End of Measurement ~~Zone~~Interval	8bits	OFDMA offset of the end of measurement ~~zone~~interval
}		
}		

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	~~Enhanced~~Periodic_Channel_Measurement_IE
0E	Reserved
~~0F~~	~~UL_interference_and_noise_level_IE~~

[Add a new section at the end of 8.4.5.3.~~32~~31]

8.4.5.3.32 ~~Enhanced~~Periodic_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 15.1.3.2.1~~6.3.15~~).

Table ~~280~~ 286ae OFDMA Periodic channel Measurement IE

Syntax	Size	Notes
~~Enhanced~~Periodic_Channel_Measurement_IE() {		
Extended DIUC	4bits	CHM=0x0D
Length	4bits	Length=0x04
Extended Channel Nr	~~8bits~~16bits	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 Measurement~~Measurement 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 ~~Zones~~Intervals	8bits	Number of frames between two available measurement frames
Start of Measurement Interval~~Zone~~	8bits	OFDMA offset of the beginning of measurement interval~~zone~~
End of Measurement Interval~~Zone~~	8bits	OFDMA offset of the end of measurement interval~~zone~~
}		
}		

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