Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
Title	A method which can Improve Capacity of WirelessMAN-CX
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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: e-mail to : fengsl@hisilicon.com
Re:	IEEE 802.16 Working Group Letter Ballot #24, on P802.16h/D1
Abstract	This contribution describes the multiple working channels mechanism which can be used in WirelessMAN-CX system, that is, system works more than one channel, during common sub-frame and main sub-frame, system work on a channel, during slave sub-frame, system works on anther channel. So system works all time and the throughput capacity of system is increased. Another benefit of this mechanism is decreasing the probability of occurrence of blind area.
Purpose	Offer a mechanism that can improve the throughput capacity of system and decrease the probability of occurrence of blind area.
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A method which can Improve Capacity of WirelessMAN-CX

Shulan Feng
Hisilicon Technologies Co., LTD

Introduction

In the current 16h draft standard, if there is not enough idle channel, BS must share channel with other system. BS and SS associated with it can do nothing during their slave sub-frame except channel measurement. Then the total capacity of BS is decreased.

Since the slave sub-frame is periodic and longe enough, so we suggest that during slave sub-frame, system may switch to another channel that may be free for this BS. Because the slave sub-frame is periodic and long enough, BS which works in slave channel is also periodic and then everything can be done during this period, including SS registration and data transmission. Following figure gives an example for type 2 sub-frame with N=3.

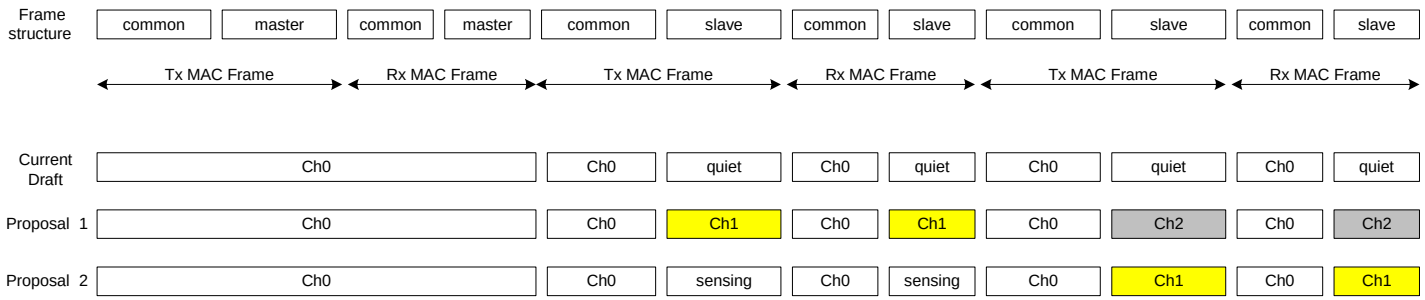

Figure 1 one example of multiple working channels

Since BS works at all time, the capacity of system is improved. And another benefit of this scheme is the probability of blind area is decreased since every BS may work independently in more than one channel.

For BS that doesn't share channel with its neighbor, it can also work at more than channel. In this case, a frame is also divided into common sub-frame and interference sub-frame and BS selects one of interference sub-frame as its master sub-frame and the other sub-frame as slave sub-frame. During common sub-frame and master sub-frame, system works on working channel; during slave sub-channel, system works on anther channel. This solution is back compatible with current draft standard [1].

To support this feature, effective channel measurement should be supported [2] and some elements should be added into the information table.

Reference

[1] IEEE 802.16h-D1: Air Interface for Fixed Broadband Wireless Access Systems: Amendment for Improved Coexistence Mechanisms for License-Exempt Operation
[2] C80216h-06_105, Using Quiet Period for Channel Measurement

Proposed Text

15.3.3 Information table

15.3.3.1 Information table in distributed database

Table h6—Information table for the BS containing this database

Syntax	Size	Notes
This BS information table(){		
BSID	48bits	
Operator ID	24bits	
IP version	1bit	0- IPv4 1- IPv6
if (IP version = 0){		
IPv4 address	32bits	IPv4 address of this BS
CXPRX IPv4 address	32bits	CXPRX IPv4 address
}		
Else{		
IPv6 address	128bits	IPv6 address of this BS
CXPRX IPv6 address	128bits	CXPRX IPv6 address
}		
RTK	16bits	Random Temporary Key
Extended Channel Number (ExChNr)	16bits	2 byte base reference to frequency range or deployment band. This reference maps to an absolute frequency value.
Base Channel Reference (BaseChRef)	8bits	1 byte specific channel number reference
Channel spacing (ChSp)	16bits	2 bytes channel spacing value (10kHz increments)
OCSI ID on working channel	8bits	CSIN of OCSI allocation on working channel
Negotiation status	8bits	Bit0: get communication in the IP network Bit1: be registered in Bit2: registered to Bit3: done for resource sharing (if neighboring) Bit4-7: tbc.
CSI parameter(){		Regulated by region/country
Tcsi_start	16bits	In microseconds
Tcsi_duration	8bits	In microseconds
Period of frames	8bits	frames
Starting frames offset	16bits	frame serial number of the first frame that CSI presented
Length of Symbols	8bits	In microseconds, need to be 1/n of Tcsi_duration
ICSI cycle	8bits	ICSI cycle counted in CSI cycles
OCSI cycle	8bits	OCSI cycle counted in ICSI cycles
}		
Number of CoNBRs	8bits	m: The number of coexistence neighbors of this BS
for (i= 1; i <= m; i++) {		
Index	16bits	Each Index here is referring to a BS in the neighborhood, and points to a set of information described in *Table h 7*
BSID	48bits	
}		
Profile(){		
Band		
PHY mode(){		
Modulation		
Working Channel ID	8bits	Identifier of the working channel of this BS.
Master Subframe ID	8bits	Sub-frame number: Bit7: sub-frame structure supported not supported supported

		Bit6: master subframe allocated do not have a master subframe have a master subframe Bit5-3: number of subframes in frame structure Bit2-1: the master subframe index this BS is using.
Number of ALTCH	8bits	p: The number of alternative channels to which this BS can switch without interference.
For (i = 1; i <= p; i++){		
Channel ID for ALTCH	8bits	Identifier of the alternative channel.
}		
Number of ALTSF	8bits	q: The number of ALTSF to which this BS can switch to without interference.
for (i = 1; i <= q; i++){		
Resource ID for the ALTSF	16bits	
}		
}		
Maximum power	8 bits	dBm
Number of registered SS on working channel	12bits	n
For (i = 1;i<=n;i++) {		
Index		
SSID		
}		
Number of slave sub-frame	2bits	r: Number of slave subframes in frame structure
For (i=0; i<=r; i++) {		
Subframe index	2bits	Sub-frame index
Slave Channel ID	8bits	The working channel ID during this slave sub-frame.
Number of registered SS on Slave Channel	12bits	s: number of SS registered on this channel
For(i=1; i<=s; i++) {		
SSID		
}		
OCSI ID	8bits	CSIN of OCSI allocation on this channel, each channel select different OCSI ID
CMI-ID	4bits	CMI ID on this channel, each channel selects different CMI ID
}		
}		

15.4.4 Multiple working channels

System may work on multiple channels. For back compatibility, a MAC frame is divided into sub-frame, and each sub-frame may work on different channel or same channel.

When BS enters network, it may follow that defined in 15.1.3 and find a suitable working channel or master sub-frame. During the operating stage, system will sense the other channel using its quiet period (see 15.3.4 [2]). If a new idle channel or idle sub-frame on other channel is found during the slave sub-frame, system may work on this channel during corresponding sub-frame.

For example, if system can find an idle channel to work during its initialization, system may let all its sub-frame work on that channel. During the operating stage, system may find another idle channel. Then during one of its sub-frame, system may work on the newest found idle channel.

If system can't find an idle channel and must share channel with other systems, system may work during its common sub-frame and master sub-frame, and be quiet during slave sub-frame. During the operating stage,

system may find there is a channel which is idle during its slave sub-frame. Then it will work on that channel during corresponding slave sub-frame.

To perform channel measurement effectively, system may reserve some slave sub-frames or a fixed period during slave sub-frames for channel measurement.