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Title	**Enhancements to Co-existence Zone (CXZ) for OFDMA PHY**
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Re:	Call for Contributions, IEEE 802.16h Task Group on License-Exempt Coexistence, IEEE 802.16h-06/005
Abstract	This document contains suggested enhancements to the working draft and base standard to facilitate a framework from which MAC enhancements for license-exempt and uncoordinated system operation can be developed.
Purpose	
Notice	
Release	
Patent Policy and Procedures	

Enhancements to Co-existence Zone (CXZ) for OFDMA PHY

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Overview

This document is presented as a discussion paper to introduce functionality and enhancements to the Co-existence Zone (CXZ) for OFDMA PHY in the 802.16h working document [**Error! Reference source not found.**] providing modification of 802.16-2004 standard [**Error! Reference source not found.**] and facilitating license-exempt and uncoordinated band operation. Specifically the discussion is centred on the following areas:

- Clarification of the permutation usage in the CXZ.
- Clarification of the use of IDcell/Permbase in the CXZ.
- Guidelines on the modulation/coding schemes used in the CXZ.
- Management of the first zone with respect to the CXZ.
- Guidelines on how MAPs are managed in a LE deployment with respect to the CXZ.

Introduction

The CXZ is a zone defined specifically for use in co-existence operation for 802.16 systems. It is assured, by mechanisms operating in a Coexistence Community and described in Chap.15, that during the Coexistence Zone the system will operate with reduced interference. A CXZ may contain any number and type of previous defined zones, like STC Zone, AAS Zone or Diversity zone. The embedded zones are PHY bursts and start with a preamble, followed by a private MAP. The CXZ is shown in Figure 1.

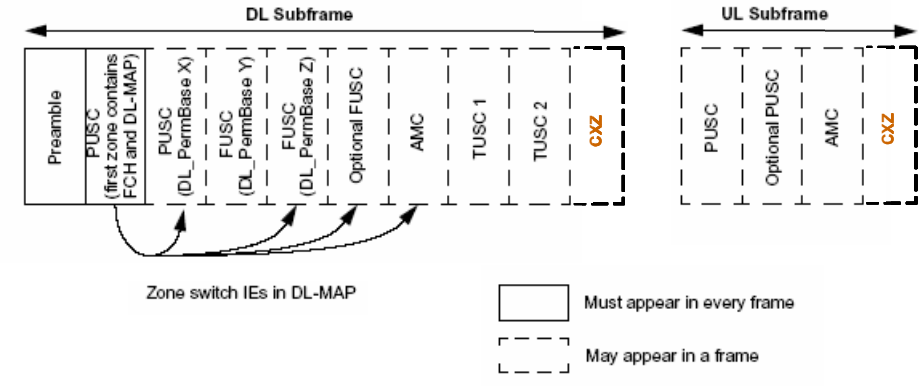

Figure 219—Illustration of OFDMA frame with multiple zones

Figure 1 Representation of the CXZ.

The CXZ is proposed to provide the following features:

- A suitable partition to add co-existence MAC enhancements. This has the advantage of simplifying the implementation and amending the base standard.
- Further addition of co-existence support structures at the MAC layer can be implemented with reduced impact on the base standard.

Detailed discussion

The OFDMA DL MAP and UL MAP are presented below:

Table 18—UL-MAP message format

Syntax	Size	Notes
UL-MAP_Message_Format() {		
Management Message Type = 3	8 bits	
~~**Uplink Channel ID**~~*reserved*	8 bits	Shall be set to zero.
UCD Count	8 bits	
Allocation Start Time	32 bits	
Begin PHY Specific Section {		See applicable PHY section.
if (WirelessMAN-OFDMA) {		
No. OFDMA symbols	8 bits	Number of OFDMA symbols in the UL subframe
}		
for (i = 1; i <= n; i++) {		For each UL-MAP element 1 to n.
UL-MAP_IE()	*variable*	See corresponding PHY specification.
}		
}		
if !(byte boundary) {		
Padding Nibble	4 bits	Padding to reach byte boundary.
}		
}		

The DL-MAP_IE and UL-MAP_IE are:

Table 275 OFDMA DL-MAP_IE format

Syntax	Size (bits)	Notes
DL_MAP_IE() {		
DIUC	4	
if (DIUC == 14) {		
Extended-2 DIUC dependent IE		
} Else if (DIUC == 15) {		
Extended DIUC dependent IE	*variable*	See clauses following 8.4.5.3.1
} else {		
if (INC_CID == 1) {		The DL-MAP starts with INC_CID =0. INC_CID is toggled between 0 and 1 by the CID-SWITCH_IE() (8.4.5.3.7)
N_CID	8	Number of CIDs assigned for this IE
for (n=0; n< N_CID; n++) {		
If (included in SUB-DL-UL-MAP) {		
RCID_IE()		For SUB-DL-UL-MAP , reduced CID format is used
} else {		
CID	16	
}		

Table 287 OFDMA UL-MAP IE format

Syntax	Size (bits)	Notes
UL-MAP_IE() {		
CID	16	
UIUC	4	
if (UIUC == 11) {		
Extended UIUC 2 dependent IE	*variable*	See subclause 8.4.5.4.4.2
}		
elseif (UIUC == 12) {		
OFDMA symbol offset	8	
Subchannel offset	7	
No. OFDMA symbols	7	
No. subchannels	7	
Ranging method	2	0b00 — Initial Ranging/Handover Rangingover two symbols 0b01 — Initial Ranging/Handover Rangingover four symbols 0b10 — BW Request/Periodic Ranging over one symbol 0b11— BW Request/Periodic Ranging over three symbols
~~*reserved*~~Dedicated ranging indicator	1	~~shall be set to zero~~ 0: the OFDMA region and Ranging Method defined are used for the purpose of normal ranging 1: the OFDMA region and Ranging Method defined are used for the purpose of ranging using dedicated CDMA code and transmission opportunities assigned in the MOB_PAG-ADV message or in the MOB_SCN-RSP message.
} else if (UIUC == 13) {		
PAPR_Reduction_and_Safety_Zone_Allocation_IE	32	
} else if (UIUC == 14) {		
CDMA_Allocation_IE()	32	
} else if (UIUC == 15) {		
Extended UIUC dependent IE	*variable*	See subclauses following 8.4.5.4.3
} else if (UIUC == 0) {		

The DIUC values are:

Table 276 OFDMA DIUC values

DIUC	Usage
0-12	Different burst profiles
13	Gap/PAPR reduction
14	~~End of map~~ Extended-2 DIUC IE
15	Extended DIUC

The extended DIUC values are:

Table 277a Extended DIUC Code Assignment for DIUC=15

Extended DIUC (hexadecimal)	Usage
00	Channel_Measurement_IE
01	STC_Zone_IE
02	AAS_DL_IE

Table 277a Extended DIUC Code Assignment for DIUC=15

Extended DIUC (hexadecimal)	Usage
03	Data_location_in_another_BS_IE
04	CID_Switch_IE
05	MIMO_DL_Basic_IE
06	MIMO_DL_Enhanced_IE
07	HARQ_Map_Pointer_IE
08	PHYMOD_DL_IE
09-0A	*reserved*
0B	DL PUSC Burst Allocation in Other Segment
0C-0E	*reserved*
0F	UL_interference_and_noise_level_IE

Table 289a Extended UIUC Code Assignment for UIUC=15

Extended UIUC (hexadecimal)	Usage
00	Power_control_IE
01	Mini-subchannel_allocation_IE
02	AAS_UL_IE
03	CQICH_Alloc_IE
04	UL Zone IE
05	PHYMOD_UL_IE
06	MIMO_UL_Basic_IE
07	UL-MAP_Fast_Tracking_IE
08	UL_PUSC_Burst_Allocation_in_Other_Segment_IE
09	Fast_Ranging_IE
0A	UL Allocation Start IE
0B 0F	*Reserved*

The CXZ IE in the DL and UL MAP indicate to interfered units where will start the communication which is less affected by interference. Inside the specific zones, being used inside a coexistence zone, the private MAPs will indicate the traffic scheduling.

Clarification on the permutation usage in the CXZ

There is no restriction on permutation usage in the CXZ. Permutation selection can be performed by using the CXZ_DL_ZONE_IE() or CXZ_UL_ZONE_IE() for downlink and uplink respectively.

Clarification of the use of IDcell/Permbase in the CXZ.

The use of DL/UL_PermBase planning across cells provides a means of reducing interference due to the nature of the codes deployed. The DL/UL_PermBase can be used on a per CXZ basis. This mechanism is similar to the one already in the base standard.

Guidelines on the modulation/coding schemes used in the CXZ

There is no restriction on modulation/coding scheme usage in the CXZ. The DL-MAP and UL-MAP can be used to provide a DIUC and UIUC coding respectively.

Management of the first zone with respect to the CXZ

The use of the CXZ within the existing frame structure is defined in Figure 1. There may be none, one or many CXZs per sub frame, both downlink and uplink. A property of the CXZ is that it may contain *private* transmissions of the frame preamble, FCH and MAPs, i.e. the first zone. This provides a time diversity component where time aligned interference from another (as yet unsynchronized) system renders the frame preamble, FCH and MAPs, at the beginning of the frame, unusable.

Guidelines on how MAPs are managed in a LE deployment with respect to the CXZ

Traditionally *private* MAPs are used in the AAS zone and are pointed to via the AAS-DLFP mechanism. Interference issues with the first zone may mean any pointer to a private first zone may be unusable; therefore private transmission of the preamble, FCH and MAPs need to be in a well known and repeatable location for new devices to synchronize to the network. Backwards compatibility needs to be maintained throughout.

Specific editorial changes

This section provides a list of changes to the draft document.

Blue text represents specific editorial additions.

~~Red strikethrough~~ text is to be deleted.

Black text is text already in the draft.

Bold italic text is editorial instructions to the editor.

Replace section 8.4.5.3.28 with the following:

Within a frame, the switch to co-existence operation is marked by using the extended DIUC = 15 with the CXZ_DL_IE(). The CXZ_DL_IE defines a DL co-existence zone and ~~that~~ spans continuous OFDMA symbols. ~~until terminated by another CXZ_DL_IE or the end of the DL frame~~. Multiple CXZs can exist within a frame. When used, the CID in the DL_MAP_IE() shall be set to the broadcast CID.

The CXZ IE in the DL MAP indicates to subscribers the start of a zone where interference may be better managed. The CXZ may contain other zones and private MAPs.

Table 286aa—~~CXZ~~ CXZ downlink IE

Syntax	Size	Notes
CXZ_DL_IE() {		
Extended DIUC	4 bits	CXZ = 0x09
Length	4 bits	Length = 0x01
OFDMA symbol offset	~~8~~ 8 bits	Denotes the start of the zone (counting from the frame preamble and starting from 0).
CXZ duration	10 bits	Denotes the duration of the zone
Next CXZ start	12bits	The time interval, in symbols, until the start of the next downlink CXZ.
}		

Replace section 8.4.5.3.29 with the following:

Within a frame, the switch to co-existence operation is marked by using the extended UIUC = 15 with the CXZ_UL_IE(). The CXZ_UL_IE defines a DL co-existence zone ~~that~~ and spans continuous OFDMA symbols.~~until terminated by another CXZ_UL_IE or the end of the DL frame~~ Multiple CXZ zones can exist within a frame. When used, the CID in the DL_MAP_IE() shall be set to the broadcast CID.

The CXZ IE in the UL MAP indicates to subscribers the start of a zone where interference may be better managed. The CXZ may contain other zones.

Table 302w—CXZ uplink IE

Syntax	Size	Notes
CXZ_UL_IE() {		
Extended DIUC	4 bits	CXZ = 0x09
Length	4 bits	Length = 0x01
OFDMA symbol offset	~~8~~ 8 bits	
CXZ duration	10 bits	Denotes the duration of the zone
Next CXZ start	12bits	The time interval, in symbols, until the start of the next uplink CXZ.
}		

Relation between the Master sub-frames and CXZ

See contribution IEEE C802.16h-06/014r1.

Text changes in Working Document, chap.15

Insert in Chap 15.2.1.1.2, after the existing text.

At the MAC level, the Master sub-frame is scheduled by using the Coexistence Zone.

The following figures show examples of the usage of the CXZ and the relation with the Master sub-frame types 1 and 3:

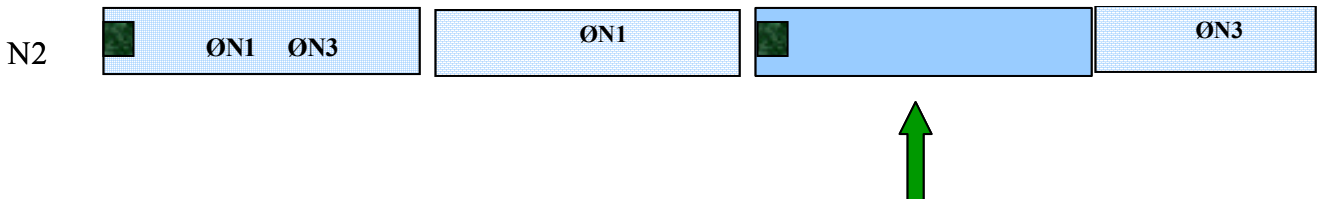

Figure hxx Relation between Master sub-frame type 1 and the CXZ

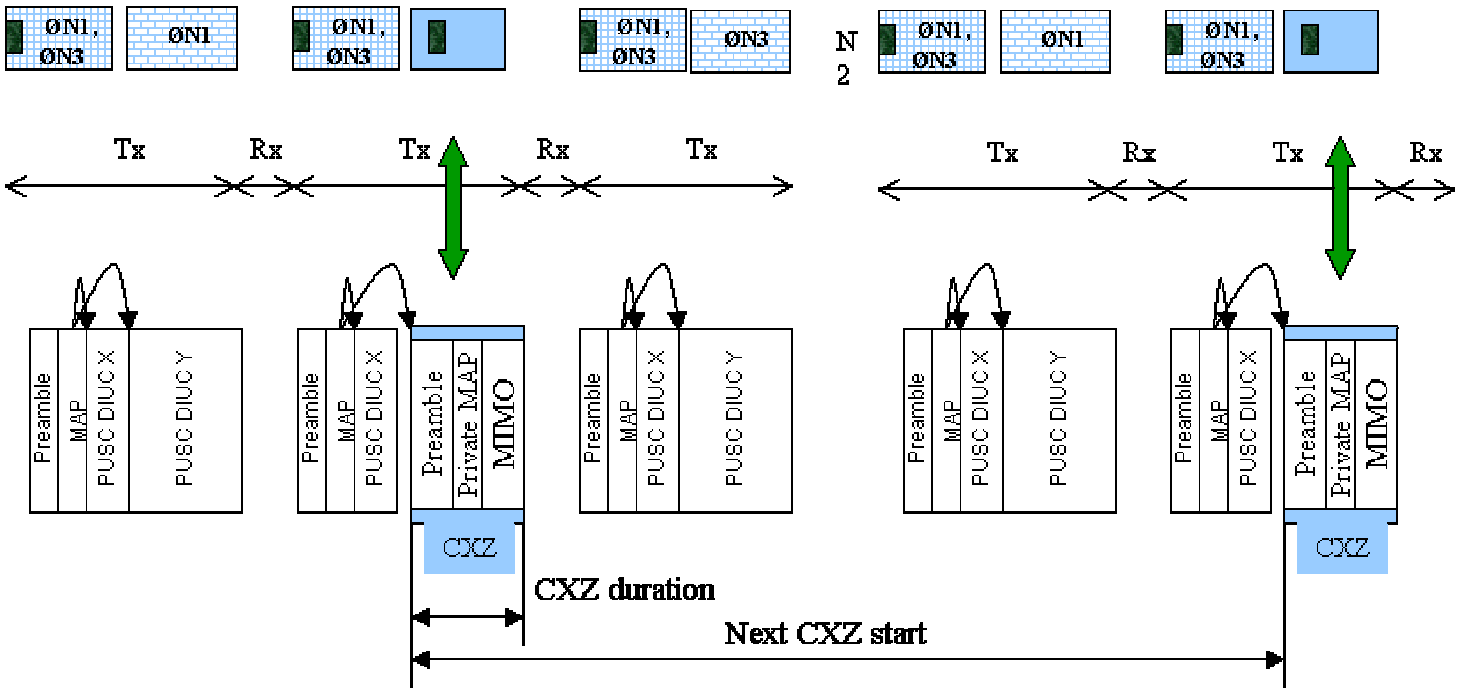

Figure hyy Relation between Master sub-frame type 3 and the CXZ

References

[1] IEEE 802.16h-06/004: *Part 16: Air Interface for Fixed Broadband Wireless Access Systems Amendment for Improved Coexistence Mechanisms for License-Exempt Operation*, Working document.

[2] IEEE 802.16-2004: *Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems*, October 2004.

[3] IEEE 802.16e – D12: Draft Amendment: *Air Interface for Fixed and Mobile Broadband Wireless Access Systems*, December 2005.

[4] IEEE C802.16h-06/014r1 Usage of the Coexistence Zone