Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Support for Intercell Interference Mitigations**
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Re:	802.16 Working Group Letter Ballot #26c
Abstract	This contribution proposes a few minor and backward compatible changes into the 802.16 Rev2/D4 that will provide the required supports to aid interference mitigation schemes for the OFDMA PHY based systems.
Purpose	To be discussed and adopted by 802.16 Rev2.
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Support for Intercell Interference Mitigations

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Introduction

Enabling frequency reuse-1 is very important for a wide adoption of 802.16e OFDMA PHY based systems, as spectrum efficiency is one of the most critical performance measures for competing wireless technologies. Intercell interference has been identified as the major problem for effectively achieving frequency reuse-1, therefore, managing interference becomes one of the most important elements to improve the system performance and hence competitive advantage of 802.16e based systems.

Interference management is achieved by a combination of interference avoidance and interference cancellation techniques. Most interference mitigation techniques are based on the knowledge of the interference properties. However, the current 802.16e does not provide adequate supports for making the interference property knowledge available for effective implementations of interference mitigation schemes. This contribution proposes a few minor and backward compatible changes into the 802.16 Rev2/D3 that will provide the required supports to aid interference mitigation schemes for the OFDMA PHY based systems.

Proposed Solution

In order to provide the required supports to aid the implementations of the interference mitigation schemes, we propose to introduce a concept, called coordinated DL zone, which is a DL zone coordinated between the servicing BS and all its neighbor BSs, including:

1. the same zone boundary;

2. the same zone permutation type, e.g., PUSC, STC PUSC, AMC, STC AMC, and FUSC;

3. no dedicated pilots;

In such a coordinated DL zone, the same zone boundary and the same zone permutation type allow for the interference to be stable, and also allow the interference properties of the neighbor BSs to be learnt by using pilot subcarriers, as the pilot subcarriers from all neighbor BSs are transmitted at the same time and the same locations. By gaining the knowledge of the interference properties from all neighbor BSs, the interference mitigation schemes can be effectively implemented.

A frame can have zero, one, or multiple coordinated DL zones. The first PUSC zone can also be a coordinated DL zone.

Permutation types, PUSC, STC-PUSC, AMC, STC-AMC, and FUSC are allowed to be used in a coordinated DL zone.

To enable the interference mitigation schemes based on the coordinated DL zone concept, the supports are needed at air interface to signal the presences of such coordinated DL zones and some PHY

properties. The current 802.16 Rev2/D3 spec does not provide adequate supports for such coordinated DL zone based signaling, thus the following few minor changes are needed in the 802.16 Rev2/D3:

1. add a TLV in SBC-REQ and SBC-RSP messages to signal the BS's supports for the coordinated DL zones and MSS's interference cancellation capability in the coordinated DL Zones;

2. add a TLV in DCD message to signal which DL zone or zones are DL coordinated zones;

3. add clarification text to enable the MS to derive the two parameters, DL_PermBase and PRBS_ID, of its neighbor BSs.

In summary, this contribution proposes few minor and backward compatible changes to the 802.16 Rev2/D4, to provide the required supports for enabling the implementation of interference mitigation schemes.

Suggested Changes in Rev2/D4

Suggested change #1:

In Rev2/D4, page 1203, line 63, insert the following subsection, where the new text is marked by blue and underlined.

11.8.17 DL Coordinated Zone capability

The "DL coordinated zone capability" field specifies that MS can exploit the knowledge of interference if the zone is coordinated between BSs (i.e., the MS in the serving sector will experience interference from coordinated BS transmission that start from the same symbol, with the same zone type, and with the same pilot positions). This field is used only for the WirelessMANOFDMA PHY. A bit value of 0 indicates "not supported" while 1 indicates "supported".

Name	Type	Length	Value	Scope
DL Coordinated Zone Capability	185	1	Bit#0: Support DL coordinated zone for non-STC PUSC Bit#1: Support DL coordinated zone for STC PUSC if all bursts uses Matrix A Bit#2: Support DL coordinated zone for STC PUSC if all bursts uses Matrix B Bit#3: Support DL coordinated zone for AMC Bit#4: Support DL coordinated zone for STC AMC if all bursts uses Matrix A Bit #5: Support DL coordinated zone for STC AMC if all bursts uses Matrix B Bit#6: Support DL coordinated zone for FUSC Bit #7 : reserved	SBC-REQ SBC-RSP

Suggested change #2:

In Rev2/D4, page 130, line54, insert the following line, where the new text is marked by blue and underlined.

DL Coordinated Zone capability (see 11.8.17)

Suggested change #3:

In Rev2/D4, page 132, line 20, insert the following line, where the new text is marked by blue and underlined.

DL Coordinated Zone capability (see 11.8.17)

Suggested change #4:

In Rev2/D4, page 1145, line 14, insert the following row in Table 563 (DCD channel encoding), where the new text is marked by blue and underlined.

Name	Type	Length	Value	PHY Scope
DL Coordinated Zone indication	62	1	Bit#0: the coordinated first DL PUSC zone indication, if set to 1, indicates the first DL PUSC zone is a coordinated zone, in which servicing BS coordinates with its neighbor BSs to have the same zone boundary and use the same "used-subchannel bitmap". If set to 0, indicates the first DL PUSC zone is not a coordinated zone. Bit#1: the coordinated second DL zone indication, if set to 1, indicates the second DL zone is a coordinated zone, in which servicing BS coordinates with its neighbor BSs to have the same zone boundary and use the same permutation. If set to 0, indicates the second DL zone does not exist or is not a coordinated zone. Bit#2: the coordinated third DL zone indication, if set to 1, indicates the third DL zone is a coordinated zone, in which servicing BS coordinates with its neighbor BSs to have the same zone boundary and use the same permutation. If set to 0, indicates the third DL zone does not exist or is not a coordinated zone. Bit#3: the coordinated fourth DL zone indication, if set to 1, indicates the fourth DL zone is a coordinated zone, in which servicing BS coordinates with its neighbor BSs to have the same zone boundary and use the same permutation. If set to 0, indicates the fourth DL zone does not exist or is not a coordinated zone. Bit#4: the coordinated fifth DL zone indication, if set to 1, indicates the fifth DL zone is a coordinated zone, in which servicing BS coordinates with its neighbor BSs to have the same zone boundary and use the same permutation. If set to 0, indicates the fifth DL zone does not exist or is not a coordinated zone; Bit#5 to Bit #7: reserved	OFDMA

Suggested change #5:

In Rev2/D4, page 721, line 9, insert the following text, where the new text is marked by blue and underlined.

DL_PermBase

DL Permutation base for the specified DL zone.

When the zone defined by this STC_DL_Zone_IE() is a DL coordinated zone, the DL_PermBase field shall be set to the 5 LSBs of IDcell as indicated by the frame preamble. A DL coordinated zone is a DL zone coordinated between the servicing BS and all its neighbor BSs, including, having the same zone boundary, the same zone permutation type, and not using dedicated plots.

PRBS_ID

Values: 0..2. Refer to 8.4.9.4.1.

When the zone defined by this STC_DL_Zone_IE() is a DL coordinated zone, the PRBS_ID field shall be set to the segment number + 1 as indicated by the frame preamble. A DL coordinated zone is a DL zone coordinated between the servicing BS and all its neighbor BSs, including, having the same zone boundary, the same zone permutation type, and not using dedicated plots.

Matrix indicator

When the zone defined by this STC_DL_Zone_IE() is a DL coordinated zone, setting Matrix indicator to be "Matrix A" means that both serving BS and its neighbor BSs uses matrix A only in this coordinated DL STC zone; setting Matrix indicator to be "Matrix B" means that both serving BS and its neighbor BSs uses matrix B only in this coordinated DL STC zone.