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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

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 serving BS and all its neighbor BSs, including:

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

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, and STC-AMC 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/D4 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/D4:

1. add the specification of the DL coordinated zone;
2. add clarification text to enable the MS to derive the two parameters, DL_PermBase and PRBS_ID, of its neighbor BSs;

3. add clarification text to specify the coordinated settings of the parameters, Use All SC, Dedicated Pilots, in the DL Zone Switch IEs of coordinated BSs;
4. add a TLV in SBC-REQ message for the MS to signal its interference cancellation capability in the coordinated DL Zones;
5. add a TLV in DCD message to signal which DL zone or zones are DL coordinated zones;

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/D5

Suggested change #1:

In Rev2/D5, page 734, line 38, replace the last sentence of the paragraph by the following text, where the new text is marked by blue and underlined.

A DL zone can be a coordinated zone between the serving BS and all its neighbor BSs that has the same zone boundary, the same zone permutation type e.g., PUSC, STC PUSC, AMC, and STC AMC, and the same values for the parameters, Use All SC and Dedicated Pilots. Within a coordinated DL zone, all the allocations shall have the parameter "boosting" set to 0b000, i.e., not boosted. A frame can have zero, one, or multiple coordinated DL zones. The first PUSC zone can also be a coordinated DL zone. When the first PUSC zone is a coordinated zone, serving BS coordinates with its neighbor BSs have the same zone boundary and use the same "used-subchannel bitmap".

The format for the STC DL Zone IE is shown in Table 327.

Suggested change #2:

In Rev2/D5, page 736, 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.

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 mod(segment number + 1, 3) as indicated by the frame preamble.

Use All SC

Indicates if all subchannels are used. Applies to PUSC only. When set to 0, do not use all

subchannels . When set to 1, use all subchannels.

When the zone defined by this STC_DL_Zone_IE() is a DL coordinated zone, the Use All SC field shall be set to the same value as that in the corresponding DL coordinated zones of all its neighbor BSs.

Suggested change #3:

In Rev2/D5, page 736, line 40, insert the following text as an additional paragraph for the “Dedicated Pilots” specification, where the new text is marked by blue and underlined.

When the zone defined by this STC_DL_Zone_IE() is a DL coordinated zone, the Dedicated Pilots field shall be set to the same value as that in the corresponding DL coordinated zones of all its neighbor BSs.

Suggested change #4:

In Rev2/D5, page 1183, line 25, insert the following row in Table 567 (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. 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. 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. 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. 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. If set to 0, indicates the fifth DL zone does not exist or is not a coordinated zone; Bit#5: DL coordinated STC PUSC zone matrix indicator if set to 1, indicates Matrix A only in the first DL STC PUSC zone. If set to 0, indicates not Matrix A only. Bit#6: DL coordinated STC AMC zone matrix indicator if set to 1, indicates Matrix A only in the first DL STC AMC zone. If set to 0, indicates not Matrix A only. Bit #7: reserved	OFDMA

Suggested change #5:

In Rev2/D5, page 1244, line 22, 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 indicates 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 optional. 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 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 Bit #6 and #7 : reserved	SBC-REQ

Suggested change #6:

In Rev2/D5, page 132, line 65, insert the following line, where the new text is marked by blue and underlined.

DL Coordinated Zone capability (see 11.8.17)