Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Correction in PUSC Renumbering Formula**
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Source(s)	Sean Cai scai@ztesandiego.com Wenzhong Zhang wzhang@ztesandiego.com Jing Wang jwang@ztesandiego.com Jason Hou jhou@ztesandiego.com Jun Han jhan@ztesandiego.com Dazi Feng dfeng@ztesandiego.com Irving Wang iwang@ztesandiego.com ZTE San Diego Inc. 10105 Pacific Heights Blvd. San Diego, CA 92121 USA Voice: 858-554-0387 Fax: 858-554-0894
Re:	Response to the call for contributions to IEEE Standard 802.16-2004, IEEE 802.16maint-04/01, 2004-08-04. Header error fix to IEEE 802.16maint-04/08.
Abstract	This contribution describes the error in PUSC cluster renumbering formula.
Purpose	To incorporate the text modification proposed in this contribution into IEEE 802.16REVd standard.
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Correction in PUSC Renumbering Formula

Sean Cai, Wenzhong Zhang, Jing Wang, Jason Hou,
Jun Han, Dazi Feng, Irving Wang

ZTE San Diego Inc.

1. Problem Statement

In ***Table 308*** of IEEE P802.16-REVd/D5-2004, the renumbering sequence for PUSC is provided to renumber clusters before subcarrier allocation to subchannels. However in ***8.4.6.1.2.1.1 Downlink subchannels subcarrier allocation in PUSC*** this Renumbering Sequence is used to renumber the physical clusters into logical clusters as a formula, in which *IDcell* is a variable for generating different mapping sequences of logical clusters. Therefore, for 2 BS (BS-A and BS-B) using 2 different *IDcell* values, the same Group number (0 … 5) in BS-A will have different physical clusters allocated than that of BS-B. The same sector number of these two BS will contain different physical clusters, in other words, sector 0 of BS-A will not be orthogonal to sector 1 and 2 of BS-B. The renumbering makes it VERY DIFFICULT or IMPOSSIBLE for 3-sector cell planning in the multicell deployment due to severe inter-cell interference, however multiple 3-sector cell deployment is very common especially in mobile networks.

Here provided is an example of typical multiple 3-sector cell deployment, as shown in Figure 1 (circled in blue). The physical cluster numbers in red are the common physical clusters that will cause interference among these sectors.

Physical Clusters (Sector = 2, IDcell = 0):
114 **3** 92 **80** **55** 88 **41** 98 94 **100** **70** 64 **68** **11** 118 25 **110** 62 **33** 84 5 **43** 66 **112**

Physical Clusters (Sector = 1, IDcell = 2):
39 77 **100** 26 79 **55** 53 **43** 35 18 **110** 51 30 4 106 61 **41** 57 **112** 63 **33** 82 27 **11**

Physical Clusters (Sector = 0, IDcell = 3):
80 9 74 58 78 **3** 81 107 **68** 7 95 52 60 **70** 72 36 103 117 34 56 15 24 113 101

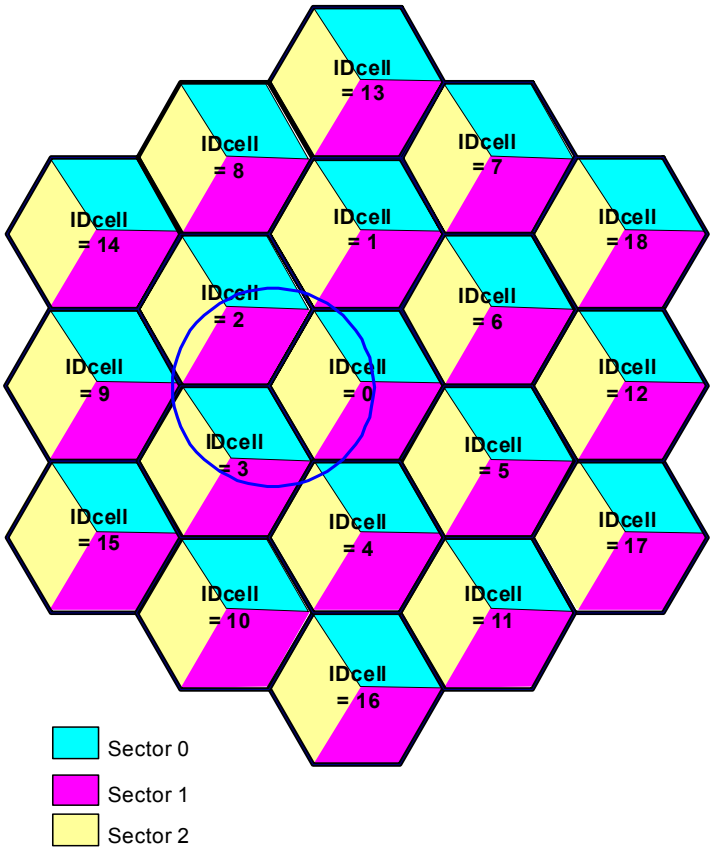

Figure 1. 3-sector cell deployment

2. Proposed solutions

Based on the interference caused by the renumbering formula, we propose to remove the formula, using the only default renumber sequence in ***Table 308*** of IEEE P802.16-REVd/D5-2004. With this change, the physical cluster assignment to the 6 cluster groups (Group 0 to 5) are fixed; all the different group number subcarrier allocation will be orthogonal to each other, with the same or different IDcell number assignment. The same example in Figure 1 (circled in blue) can be used here. There are no colliding physical clusters from different sectors.

Physical Clusters (Sector = 2, IDcell = 0):
114 3 92 80 55 88 41 98 94 100 70 64 68 11 118 25 110 62 33 84 5 43 66 112

Physical Clusters (Sector = 1, IDcell = 2):
65 103 6 52 105 81 79 69 61 44 16 77 56 30 12 87 67 83 18 89 59 108 53 37

Physical Clusters (Sector = 0, IDcell = 3):
119 48 113 97 117 42 0 26 107 46 14 91 99 109 111 75 22 36 73 95 54 63 32 20

The interference caused by the sectors with the same group numbers of different BS, typically from second tier cells (such as sector 0 of IDcell 12 BS to sector 0 of IDcell 0 BS, as depicted in Figure 1), can still be mitigated with the help of current subcarriers permutation scheme defined in the standard; sectors from different cells may have the same physical clusters however their logical subchannels can be different due to intra-group data subcarrier permutation based on different IDcell numbers.

3. Specific text changes

[*Modify the following text to section* ***8.4.6.1.2.1.1 Downlink subchannels subcarrier allocation in PUSC*** *[1] bullet 2)*]

=== Start text changes ====

2) Renumbering the physical clusters into logical clusters using the following formula:
LogicalCluster = RenumberingSequence(~~(~~PhysicalCluster~~+13*IDcell) mod 120~~)
~~In the first PUSC zone of the downlink (first downlink zone) the default used IDcell is 0.~~

=== End text changes ====

4. References

[1] IEEE P802.16-REVd/D5-2004