Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**	
Title	**Rapporteur Group for Prject 802.16m Downlink Physical Structure Chairs Report**	
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Re:	IEEE802.16m-08/015r1 (“Charter and Scope of TGm Rapporteur Groups”)	
Abstract	Chairs’ Report for the Downlink Physical Structure Rapporteur Group	
Purpose	Report on the activities of the DL PHY Rapporteur Group	
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Rapporteur Group for Project 802.16m Downlink Physical Structure: Chair's Report

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Rapporteur Group Chairs

Work Plan

The Rapp Group work plan consisted of generating four drafts of proposed SDD text based on contributions and comments from the Rapp Group. The first three drafts were used to find consensus on high-level issues and to lay the foundation for further discussion on more specific details.

Drafts and Documents

- Draft 1 (C802.16mDL_PHY-08/009) was a proposed Table of Contents that served as the fundamental structure to which contributions and comments were addressed. Draft 1 was based on recommendations by the group.

- Draft 2 (released as C802.16mDL_PHY-08/009r2) was a consolidation of all contributions from Session 54 that were related to DL PHY structure. Contributions were modified to fit the Table of Contents in Draft 1 and re-submitted to the Rapp Group upload area. As part of Draft 2, the Rapp Group Chairs highlighted what was considered "consensus" text that would eventually become part of the final draft. Contributors were invited to comment on this text for Draft 2 and all the drafts that followed.

- Draft 3 (C802.16mDL_PHY-08/009r3) included new text from contributors who did not submit contributions during Session 54 as well as harmonized contributions.

- Draft 3a (C802.16mDL_PHY-08/009r4, C802.16mDL_PHY-08/009r5): Although the harmonized contributions resulted in the elimination of some (older) text in the Draft, it was not always clear which text could be removed. Contributors were asked to confirm that highlighted "strike-through" text in Draft 3 was correctly identified and could be removed from the document. The final version of Draft 3a, C802.16mDL_PHY-08/009r5, has been uploaded to the Member Upload Area.

- DL PHY Structure Discussion Items (C802.16mDL_PHY-08/028r3) is a spreadsheet containing high level design ideas proposed by each contributor. This table was used to determine areas to consider and levels of consensus in each of those areas. The table also contains submission highlights on criteria for comparison of pilot patterns, which will be used as we move to more detailed study of various pilot patterns proposed by the members.

- Final Draft (C802.16mDL_PHY-08/046) contains all of the consensus text (as defined by the DL PHY Structure Discussion Items table and the highlighted text in Drafts 2, 3, and 3a). This draft will serve as the starting point for further discussion on PHY structure.

- TGm Contribution (C802.16m-08/517) contains consensus text created by the break-out group during Session 55 in Macao.

Areas of Consensus (Reflector)

11.5 High-level Description

We have general consensus for the high-level description of the downlink physical structure as defined in clause 11.5, including a hierarchical representation of the DL physical structure.

11.5.1 Physical and Logical Resources Units

In general, the agreement for the physical resource unit (PRU) size is an 18-subcarrier by 6-OFDM-symbol regular subframe, and an 18-subcarrier by 5-OFDM-symbol irregular subframe. The logical resource unit (LRU) is the same size as the PRU.

11.5.1.1 Distributed Resource Unit

We have a general definition of a distributed resource unit (DRU), but the minimum unit for forming the DRU is still under discussion. We may only need to decide between using one subcarrier or a fraction of the PRU as the minimum unit, but this work is FFS.

11.5.1.2 Localized Resource Unit

Currently the general agreement is for the localized resource unit (LLRU) to contain contiguous subcarriers across the localized resource allocation, and to be the same size as a PRU.

11.5.2 Subchannelization and Resource Mapping

The general description for this section requires more input from the group.

11.5.2.1 Basic Symbol Structure

We have a general description for the basic symbol structure.

11.5.2.2 Downlink Subcarrier to Resource Unit Mapping

Resource allocation unit multiplexing is performed using frequency division multiplexing (FDM). We have agreed on a basic method for resource unit mapping.

11.5.2.3 Subchannelization for DL Distributed Resource

The spreading technique defined for the distributed resource is FFS. The granularity for the inner permutation is equal to the minimum unit to be defined in 11.5.1.1.

11.5.2.4 Subchannelization for DL Localized Resource

Localized resource allocation for the DL does not have a second-level permutation, and PRUs are directly mapped to localized resources within each frequency partition.

11.5.3 Pilot Structure

The pilot structure section had a great deal of discussion and activity. We began work on comparison and evaluation criteria, and that work will continue through Session 55 where we hope to come away with clear parameters for simulation work and comparison tables.

Areas Requiring More Work (before Session 55)

New Concepts

There were several proposals for concepts outside the published Table of Contents, and because only one or two members submitted ideas and little or no discussion arose, we feel that there is no consensus on these topics and they are best served through face-to-face discussion during Session 55. This is by no means a judgment of the contributions in question, but rather a recognition that some topics were of high interest and resulted in strong consensus, and it is those essential topics that should form the basis of the starting point of the Rapp Group draft. Some other topics, such as pilot density and co-located pilots were mentioned, but without any discussion, we do not have a good feel for whether the group is in favor of or against these ideas.

Other Concepts

“Equal pilot density per Tx stream” was somewhat agreed with ten contributors in favor and four against, but this may require more discussion. “Equal pilot density per OFDM symbol” was closer with eight against and five in favor of the idea. Another area that needs more discussion is “Pilot collision avoidance between sectors, where approximately 2/3 are in favor and 1/3 is against.

Pilot Pattern Evaluations

Probably the area with the most work ahead is the evaluation of specific pilot patterns. We have a foundation

for comparison, but we need to form a consensus on the evaluation methodologies so that people are able to produce “fair comparison” simulation results that will help us decide on specific patterns.

Moving Forward

We have uploaded the Final Draft document as C802.16mDL_PHY-08/046. Because it only contains text we feel has a clear consensus, it is somewhat sparse. However, we feel it does contain the essential structure we need to move forward and begin discussion on more detailed decisions. Inclusion (or exclusion) of text does not mean that specific contributions were endorsed or rejected. We feel that it was important to start with a document that, while high-level, could be included into the SDD without any major objections. From this foundation, we can discuss and add details in a methodical way. We would like to thank all of the contributors and invite everyone to begin the next step in the process by issuing comments against C802.16mDL_PHY-08/046.

Because all of the harmonized text remains in C802.16mDL_PHY-08/009r5, we have retained that information, which obviously can be used as a reference for submissions against C802.16mDL_PHY-08/046.

Session 55 Break-out Group Notes

Highlights

May 13, 2008

- C802.16mDL_PHY-046 comment resolution

May 14, 2008

- C802.16mDL_PHY-046 comment resolution
- Prepare Pilot Performance Metrics Text
- Review C802.16m-08/517 (SDD text)
- Review Performance Metrics text (to be included in this document as an appendix)

Detailed Notes

The DL PHY RG met for two days, May 13 and May 14, for the purpose of resolving the submitted comments to C802.16mDL_PHY-046. On May 13, after the presentation of the agenda, which was received with no comments from the group, we entered the comments resolution phase, which addressed Comments 1 to 58. On May 14, the rest of the comments (59 to 69) were resolved. The resolution of the submitted comments led to two outputs: The first one is the input document of the DL PHY RG to the SDD and the second one contains the simulation parameters and performance metrics for evaluating the pilot patterns submitted to the RG. After the completion of the comments resolution phase, the document to be submitted to TGm for inclusion in the SDD was reviewed with the group and no objections were raised. Then, the text containing the simulation parameters and performance metrics for evaluating the pilot patterns was also reviewed with the group and finalized after some clarification text, unanimously agreed by the RG, was added to the original text.

Appendix A: Simulation Parameters and Performance Metrics for Evaluating Pilot Patterns

1. Antenna configurations: 2 or 4 Tx antennas (4 lambda spacing), 2 or 4 Rx antennas (0.5 lambda spacing) and with zero correlation.
2. Transmission schemes/pilot type:
    a. Open-loop with common pilots: For 2 Tx case, 1 spatial stream with STBC/SFBC (regular subframes) and 2 spatial streams with SM. For 4 Tx case, 1 spatial stream for STBC/SFBC and 4 spatial streams for SM.
    b. Dedicated pilots with 4 Tx antennas and 2 Rx antennas, SVD beamforming with ideal channel knowledge, single spatial stream and MRC receiver.
3. Interference type:
    a. Noise limited
    b. Interference limited (2 interfering BS signals with equal power ratio)
4. Channel model:
    a. For common pilots: Extended ITU PedB 3 km/h, VehA 120 km/h, VehA 350 km/h
    b. For dedicated pilots: Extended ITU PedB 3 km/h, VehA 120 km/h, VehA 350 km/h.
5. Receiver type:
    a. Channel estimation type:
        i. Narrowband MMSE over one PRU.
        ii. Channel statistics are assumed to be unknown at the receiver.
        iii. Performing MMSE channel estimation using pilots over multiple PRUs is also allowed if the pilot structure enables such a usage.
    b. Data detection type: MMSE for STBC and SM.
6. Number of resource blocks: Two LRUs for both distributed and localized allocations.
7. Performance metrics:
    a. Throughput vs. SNR/ SINR with pilot overhead accounting and assuming perfect link adaptation
    b. MSE (mean squared error) vs. SNR/SINR; all simulations without HARQ
    c. Performance metric and simulation method:
        i. Step 1: Run link level simulation for different MCS, which includes fading channel model, modulation/demodulation, encoding/decoding, channel estimation to generate long term PER versus SINR plots
        ii. Step 2: convert PER versus SINR plots to throughput versus SINR plots. Throughput is defined below.
        iii. Combine throughput versus SINR curves generated from different MCSs

    Throughput = (1-PER)*(number of information bits)/(subframe duration). The number of information bits is adjusted based on the MCS level in order to fit the information payload to the resource size of two LRUs as defined in item 6.