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| | Project 802.16m UL Control Rapporteur Group Chairs | |
| Re: | IEEE 802.16m-08/023, Charter and Scope of New TGM Rapporteur Groups | |
| Abstract | Report out on the activity of the TGM chartered UL Control Rapporteur Group | |
| Purpose | For discussion in TGM | |
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Project 802.16m UL Control Structure Rapporteur Group Report

Roshni Srinivasan, Andrea Bacioccola

Project 802.16m UL Control Rapporteur Group Chairs

On May 15, 2008, TGm announced the formation of five Rapporteur Groups, an HARQ Rapporteur Group, a Preamble Rapporteur Group, a DL MIMO Rapporteur Group, an Uplink Control Rapporteur and an Uplink PHY Rapporteur Group. IEEE 802.16m-08/023 identified the organization, operation, timeline, and output for the Uplink Control Rapporteur Group as follows:

“The Uplink Control [“UL Ctrl”] Rapporteur Group is chartered to develop proposed baseline content regarding the Uplink Control structure suitable for use in the 802.16m System Description Document (SDD). It shall be submitted by the Rapporteur Group as a Task Group m contribution by 7 July 2008, with the expectation that it could be accepted by Task Group m at Session #56. The Rapporteur Group shall also submit a report of its activities as a TGm contribution by the same deadline. Rapporteur Group Chairs are Roshni Srinivasan, and Andrea Bacioccola.”

IEEE 802.16m-08/023 further specified:

“All Rapporteur Group discussions will take place on the TGm reflector <<http://dot16mreflector.wirelessman.org>>, not by teleconference or other means. All message input to the Rapporteur Groups shall be copied to the TGm reflector. Message subjects will begin with the tags “[HARQ]”, “[Preamble]”, “[DL MIMO]”, “[UL Ctrl]” and “[UL PHY]” respectively. Contributions intended for the Rapporteur groups should be uploaded to the appropriate password-protected directories newly established for this purpose: <<http://memberupload.wirelessman.org>>.”

Based on the defined charter, the activities of the UL Control Rapporteur Group were kicked off on 5/19/2008. A work plan was proposed by the Rapporteur Group Chairs in contribution C802.16m-UL_ctrl/001 and adopted by the Rapporteur Group. The plan was to develop harmonized SDD text for Project 802.16m uplink control structure based on proposals submitted in Session #55, build consensus and identify proposals that require further harmonization/down selection, and develop a report to capture relevant aspects of the discussions in the Rapporteur Group.

As per the work plan, a list of contributions from Session #55 on UL control structure was uploaded by the Rapporteur Group Chairs on 5/20/2008 as contribution C802.16m-UL_ctrl-08/002. The list was subsequently revised based on feedback from members. The following list of contributions in C802.16m-UL_ctrl-08/002r1 was compiled as a starting point for development of baseline content for SDD text on the 802.16m UL control structure.

| Contribution | Title | Source |
|------------------|---|------------------------------|
| C80216m-08_272 | <i>IEEE 802.16m Uplink Control Channels</i> | Motorola Inc |
| C80216m-08_275 | <i>IEEE 802.16m UL Common Feedback</i> | Motorola Inc |
| C80216m-08_284r1 | <i>Proposed UL Control Structure for 802.16m system</i> | Samsung Electronics Co., Ltd |

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|------------------|---|------------------------|
| C80216m-08_288r2 | <i>UL Control Channel Allocation</i> | Nokia Siemens Networks |
| C80216m-08_303r3 | <i>Proposal for Multicarrier uplink control structure</i> | ITRI, NCTU/ITRI |
| C80216m-08_304r3 | <i>Proposal for Multicarrier Bandwidth Request Control Mechanism</i> | ITRI, NCTU/ITRI |
| C80216m-08_318 | <i>Uplink Control Structure, Ranging and Initialization Procedure with Multi-carrier Support for IEEE 802.16m</i> | MediaTek Inc. |
| C80216m-08_321r1 | <i>Design Considerations for UL Ranging Channel in 802.16m</i> | MediaTek Inc. |
| C80216m-08_329r1 | <i>Ranging Code Design for IEEE 802.16m</i> | NCTU/MediaTek Inc |
| C80216m-08_351 | <i>Proposal for IEEE 802.16m UL Control Structures</i> | Nortel Networks |
| C80216m-08_352r2 | <i>Proposal for IEEE 802.16m UL Access and Resource Request Channels</i> | Nortel Networks |
| C80216m-08_368r1 | <i>BW-REQ channel requirements and design recommendations for IEEE 802.16m</i> | Intel Corporation |
| C80216m-08_375r1 | <i>Uplink Control Structure for RACH and PRCH</i> | ETRI |
| C80216m-08_384 | <i>Uplink Control Channel Structure</i> | Nokia and NSN |
| C80216m-08_391 | <i>Proposal for IEEE 802.16m CQI Feedback Framework</i> | Intel Corporation |
| C80216m-08_417r1 | <i>UL fast bandwidth request control schemes</i> | Alcatel Shanghai Bell |
| C80216m-08_419r1 | <i>Selective Opportunistic Beamforming for DL MIMO</i> | Huawei Technologies |
| C80216m-08_420r2 | <i>CSI feedback scheme for downlink MIMO in TDD mode</i> | Huawei Technologies |
| C80216m-08_421r2 | <i>Double-Stage DL MU-MIMO Scheme</i> | Huawei Technologies |
| C80216m-08_422r1 | <i>Progressive Feedback Scheme for High Resolution MIMO Codebook</i> | Huawei Technologies |
| C80216m-08_447 | <i>UL control structure for IEEE 802.16m Systems</i> | LG Electronics |
| C80216m-08_448r1 | <i>Initial/Handover Ranging for IEEE 802.16m System</i> | LG Electronics |
| C80216m-08_456 | <i>UL Control Channels in IEEE 802.16m</i> | ETRI |
| C80216m-08_471 | <i>Uplink Control Structures</i> | Huawei |

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2 **Development of Initial Draft: C802.16mUL_ctrl-08/003r1**

3 The list of contributions from Session #55 on UL control structure was taken into account to form the
4 Initial Draft containing the ToC for Uplink control. Contribution C802.16mUL_ctrl-08/003 was
5 uploaded by the UL Control Rapporteur Group Chairs on 05/24/2008 and it contained the first version
6 of ToC.

7 In order to provide a general framework for SDD text for the UL Control Structure, the ToC in the draft
8 was organized by function. References to specific solutions and related terminology were not
9 included. Based on the proposals submitted, information that could be included in each section was

1 provided in bracketed text. Dependencies on text in the SDD that is still under development was
2 captured in notes wherever applicable.

3 Several changes were proposed by Rapporteur Group members to improve the organization and
4 structure of the Initial Draft. It was agreed that 'Ranging' was preferred to 'Random Access' to
5 describe the control channels used for UL synchronization. 'Uplink Synchronization Information' was
6 chosen to describe the class of ranging and synchronization information. A section on 'Inband Control
7 Signaling' was added to include UL control information that may be multiplexed with data on the UL
8 data channels as MAC headers, indicators or management messages.
9

10 The suggested changes in these comments were incorporated into the ToC and an updated version
11 of contribution, C802.16mUL_ctrl-08/003r1 was uploaded by the UL Control Rapporteur Group Chairs
12 on 05/27/2008.

13 **Development of Intermediate Draft: C802.16m-UL_ctrl-08/003r2**

14 In preparation for the Intermediate Draft, authors of contributions that were submitted in Session #55
15 with content on uplink control structure were requested to provide SDD text that would fit in with the
16 structure of the ToC proposed in the Initial Draft. While this was not mandatory, authors could ensure
17 that proposed text is adequately represented in the Intermediate Draft. Whenever possible, authors
18 were also encouraged to provide harmonized text with authors of other contributions with a similar
19 philosophy.
20

21 Since the ToC in Initial Draft was a consolidation of inputs from all proposals submitted, authors were
22 also requested to include additional sections where proposed text in their contributions could not be
23 included in the framework of Initial Draft for further consideration.

24 The following table provides a list of the 14 contributions were uploaded on 06/06/2008 by Rapporteur
25 Group members in response to the call for contributions on SDD text in the framework of Initial Draft.
26 These contributions formed the basis for Intermediate Draft.
27

| Contribution | Title, Authors |
|-----------------------------------|--|
| C80216mUL_ctrl-08_007.doc | <i>Intermediate Draft : SDD Text Proposal on Uplink Control Structure, Choong Il Yeh, Young Seog Song, Seung Joon Lee, Byung-Jae Kwak, Jihyung Kim, Wooram Shin, Dong Seung Kwon</i> |
| C802.16mUL_ctrl-08/003r1_Nextwave | <i>Intermediate Draft: Table of Contents for SDD Text on the Uplink Control Structure, Ron Porat</i> |
| C80216mUL_ctrl-08_008.doc | <i>Intermediate Draft : SDD Text Proposal on Uplink Control Structure (ITRI), Chie Ming Chou, Richard Li, Frank Ren, Chun-Yen Wang, Wern-Ho Sheen</i> |
| C80216mUL_ctrl-08_009.doc | <i>Proposed SDD Text for the Intermediate Draft on UL Control Structure, Sungcheol Chang, Kwangjae Lim, Sungkyung Kim, Sunggeun Jin, Seokheon Cho, Jungim Kim, Chulsik Yoon</i> |
| C80216mUL_ctrl-08_010.doc | <i>Intermediate Draft: SDD Text Proposal on Uplink Control Structure, D. J. Shyy</i> |
| C80216mUL_ctrl-08_011.doc | <i>Proposed SDD Text for Uplink Control Structure Intermediate Draft, Mark Cudak, Fan Wang, Amitava Ghosh, Fred Vook</i> |
| C802.16mUL_ctrl- | <i>Intermediate Draft: Proposed SDD Text on Uplink Control Structure,</i> |

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|--|---|
| 08/012.doc(AB: this upload superceed 003r1_Nortel) | Sophie Vrzic, Robert Novak, Dongsheng Yu, Mo-Han Fong, Jun Yuan, Sang-Youb Kim, Kathiravetpillai Sivanesan |
| C80216mUL_ctrl-08_014.doc | Proposed Text for Intermediate Draft of Uplink Control Structure in SDD based on Contribution C802.16m-08/368r1 and C80216mUL_ctr-08/013, Xiangying Yang, Shahrnaz Azizi, Hujun Yin, Sassan Ahmadi Qinghua Li |
| C80216mUL_ctrl-08_015.doc | <i>Proposed Text for Intermediate Draft of Uplink Control Structure in SDD</i> , Yih-Shen Chen, Kelvin Chou, Pei-Kai Liao, I-Kang and Paul Cheng, Kuhn-Chang Lin, and Yu T. Su |
| C80216mUL_ctrl-08_016.doc | <i>Proposed SDD Text for Uplink Control Structure Intermediate Draft</i> , Rath Vannithamby, Hongmei, Sun, Hua Yang, Roshni Srinivasan, Guangjie Li, Hujun Yin, Sassan Ahmadi |
| C80216mUL_ctrl-08_017.doc | <i>Intermediate Draft : Proposed SDD text on UL Control Structure</i> , Jinyoung Chun, Heejeong Cho, HyunWoo Lee, Bin-Chul Ihm, Young-Hyoun Kwon, Jin Sam Kawk |
| C80216mUL_ctrl-08_018.doc | <i>Intermediate Draft : Proposed Harmonized SDD text on UL Control Structure (sub-clause 11.x.2.4.1)</i> , HyunWoo Lee, Young-Hyoun Kwon, Jin Sam Kawk, Sungho Moon, Xin Chang, Hongjie Si, Mingyang Sun, Jia Lin, Juejun Liu, Jianmin Lu |
| C80216mUL_ctrl-08_019.doc | <i>Proposed Text for Intermediate Draft of Uplink Control Structure in SDD based on Contribution C802.16m-08/417</i> , Jimin Liu, Wu Zheng, Xiaobing Leng, Gang Shen, Kaibin Zhang, Shan Jin |
| C80216mUL_ctrl-08_020.doc | <i>Proposed Text for Intermediate Draft of Uplink Control Structure in SDD</i> , Xin Chang, Hongjie Si, Mingyang Sun, Jia Lin, Yunsong Yang, Yang Tang |

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2 Contribution C802.16m-UL_ctrl-08/021 with merged text from all contributions submitted to the
3 Rapporteur Group was uploaded on 06/10/2008 by the UL Control Rapporteur Group Chairs.
4 Proposed text from the various contributions was included as is. This document was used as a
5 guideline to identify areas of consensus as well as concepts/proposed text that required further
6 harmonization.

7
8 Discussions in the Rapporteur Group following the release of contribution C802.16m-UL_ctrl-08/021
9 included some editorial comments on the contribution. Additional text identified by the comments was
10 included into the updated version of contribution C802.16m-UL_ctrl-08/021r1, which was uploaded on
11 06/13/2008.

12 The Intermediate Draft was uploaded as contribution C802.16m-UL_ctrl-08/003r2 by the Rapporteur
13 Group Chairs on 06/18/2008. Areas where consensus or general agreement was observed were
14 identified and corresponding text was included wherever possible. Text capturing common aspects of
15 proposals was added where general agreement or consensus was observed. In areas where options
16 could be identified clearly, bracketed SDD text for consideration by the group was proposed. Items
17 pending resolution were identified in each section. References to specific solutions and related
18 terminology, detailed procedural text and information were not included. Dependencies on text in the
19 SDD that is still under development were captured in notes wherever applicable.

1 Members were encouraged to discuss the Intermediate Draft until AoE, Wednesday, 7/2/2008. During
2 this review period, contributions to support comments on the draft and facilitate harmonization were
3 invited from any member of the Rapporteur Group and consensus material and proposed changes
4 from this final phase of discussion would be incorporated in the Final Draft.
5

6 Discussions related to the structure of the fast feedback channel led to the identification of two
7 options. One proposal favored the classification of the fast feedback channel into primary and
8 secondary feedback channels. The other proposal did not favor the classification. Several
9 components of the structure of the fast feedback channel including multiplexing of multiple fast
10 feedback channels, transmission format and information content were discussed. Bracketed text was
11 added for each option corresponding to the topics that were discussed.
12

13 Transmission of HARQ feedback on the UL fast feedback control channel was discussed and was
14 included as an option FFS. Transmission of addition information in the bandwidth request channel
15 was also discussed and bandwidth request size, MS-ID, UL transmit power report, and CINR report
16 were included as potential candidates for FFS.
17

18 Discussions on the functionality of the ranging channel led to a separation of the Ranging and
19 Bandwidth Request Channels. It was agreed that Uplink Synchronization would be supported on the
20 Ranging Channel. Contention-based versus non-contention based techniques were discussed in
21 great detail and options for initial, handover and periodic ranging were identified in the draft. Support
22 for user classification in the ranging process based on operator-specific network performance
23 requirements and SLAs was also included as an optional for consideration.
24

25 In order to keep Rapporteur Group members informed of the changes that were being incorporated in
26 the draft as a result of the discussions and harmonization on the reflector, two updates to the
27 Intermediate Draft C802.16m-UL_ctrl-08/003r3 and C802.16m-UL_ctrl-08/003r4 were uploaded on
28 6/25/08 and 7/1/08 respectively.
29

30 **Development of Final Draft: IEEE C802.16m-08/725**

31 Since the discussions on the reflector led to several changes that further improved the Intermediate
32 Draft, the Rapporteur Group Chairs extended the original deadline of 7/2/08 for comments on the
33 Intermediate Draft. Members were encouraged to use the rest of the week to continue discussion on
34 the draft and provide feedback on the reflector no later than AoE Friday, 7/4/08. The outcomes of this
35 final phase of the discussions are reflected in the Final Contribution.
36
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38 The Final Contribution, C802.16m-08/725 with proposed baseline content on the Uplink Control
39 Structure for the 802.16m SDD, was submitted to TGm on Monday, 7/7/2008.
40

41 A call for comments on IEEE C802.16m-08/725 with a deadline of noon, Denver time, July 14, 2008
42 was issued as the next step in the development of SDD text on the 802.16m Uplink Control Structure.
43 Members were invited to submit comments and supporting text to build on the baseline content
44 drafted by the UL Control Rapporteur Group.

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UL PHY and UL Control Rapporteur Group Collaboration

It was observed that some material related to the PHY structure for UL control channels in contributions submitted in Session #55 still remains to be addressed by UL Ctrl and UL PHY Rapporteur Groups.

In order to move forward with developing SDD content on this topic, high level UL PHY design requirements and comparison criteria were solicited to support various UL Control Channels (Ranging, ACK/NACK, Fast Feedback etc.) as outlined in Appendix A of the most recent version of the UL PHY Rapporteur Group contribution. Members of the UL Ctrl or UL PHY Rapporteur Groups were requested to propose such criteria on the reflector for discussion. Proposals could also be submitted as UL Control RG contributions and uploaded in the member upload directory for UL Control.

Harmonized criteria discussed on the reflector until Friday, 07/11/08 would be captured in an update to the UL Control RG report on Monday, 7/14/08. A joint session of the UL PHY and UL Control Rapporteur Groups in Denver was planned to address these proposals and develop harmonized text that may be included in Appendix A of the final UL PHY Rapporteur Group contribution.