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Title	**Proposed Text of Power Control for the IEEE 802.16m Amendment**
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Re:	"802.16m amendment text": IEEE 802.16m-09/0012, "Call for Contributions on Project 802.16m Draft Amendment Content". Target topic: "11.1 Power control".
Abstract	The contribution proposes the text of power control section to be included in the 802.16m amendment.
Purpose	To be discussed and adopted by TGm for the 802.16m amendment.
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Proposed Text of Power Control for the IEEE 802.16m Amendment

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1. Introduction

The contribution proposes the text of Power Control section to be included in the 802.16m amendment. The proposed text is developed so that it can be readily combined with IEEE P802.16 Rev2/D9 [1], it is compliant to the 802.16m SRD [2] and the 802.16m SDD [3], and it follows the style and format guidelines in [4].

2. Modifications to the SDD text

The text proposed in this contribution is based on power control section in the IEEE 802.16m SDD [3].

3. References

[1] IEEE P802.16 Rev2/D9, “Draft IEEE Standard for Local and Metropolitan Area Networks: Air Interface for Broadband Wireless Access,”.

[2] IEEE 802.16m-07/002r7, “802.16m System Requirements”

[3] IEEE 802.16m-08/003r7, “The Draft IEEE 802.16m System Description Document”

[4] IEEE 802.16m-08/043, “Style guide for writing the IEEE 802.16m amendment”

4. Text proposal for inclusion in the 802.16m amendment

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1.1 Power Control

The power control scheme is supported for DL and UL based on the frame structure, DL/UL control structures, and fractional frequency reuse (FFR).

1.1.1 Downlink Power Control

The ABS should be capable of controlling the transmit power per subframe and per user. With downlink power control, each user-specific information or control information would be received by the AMS with the controlled power level. DL Advanced MAP (A:MAP) should be power controlled based on AMS UL channel quality feedback. Further, in order to make the downlink power control robust, the AMS UL channel quality feedback values should be filtered in time.

The per pilot tone power and the per data tone power can jointly be adjusted for adaptive downlink power control. In the case of dedicated pilots this is done on a per user basis and in the case of common pilots this is done jointly for the users sharing the pilots.

Power Control in DL supports Single-User MIMO and Multi-User MIMO applications.

1.1.2 Uplink Power Control

Uplink power control is supported to compensate the path loss, shadowing, fast fading and implementation loss. Uplink power control should also be used to control inter-cell and intra-cell interference level. Uplink power control is aiming at enhancing the overall system performance and reducing of battery consumption. Uplink power control consists of two different modes: open-loop power control (OLPC) and closed-loop power control (CLPC). ABS can transmit necessary information through control channel or message to AMSs to support uplink power control. The parameters of power control algorithm are optimized on system-wide basis by the ABS, and broadcasted periodically or trigged by events.

AMS can transmit necessary information through control channel or message to the ABS to support uplink power control. ABS can exchange necessary information with neighbor ABSs through backbone network to support uplink power control.

To fulfill uplink power control, a table of target CINR corresponding to different MCS should be communicated to the AMS by ABS. Further, an offset for uplink control channel should be transmitted to AMS by ABS. For uplink data channel, an additional offset should be transmitted to AMS by ABS to optimize the capacity. These offset values can be transmitted through DL message, UL allocation IEs, or adjusted through closed loop uplink power control. For uplink sounding, the ABS should transmit a target per-carrier CINR to the AMS to be used when transmitting the sounding waveform.

Open-loop Power Control (OLPC)

The OLPC compensates the channel variations and implementation loss without frequently interacting with ABS. The AMS can determine the transmit power based on the transmission parameters sent by the ABS, uplink channel transmission quality (e.g. indicated as ACK or NACK), downlink channel state information and interference knowledge obtained from downlink. Mobile stations use uplink open loop power control applying channel and interference knowledge to operate at optimum power settings.

Open-loop power control could provide a coarse initial power setting of the terminal at the beginning of a connection.

As for mitigating inter-cell interference, power control may consider serving ABS link target SINR and/or target Interference to other cells/sectors. In order to achieve target SINR, the serving ABS path-loss can be fully or partially compensated for a tradeoff between overall system throughput and cell edge performance. When considering target interference to other cells/sectors, mobile station TX power is controlled to generate less interference than the target interference levels. The compensation factor and interference targets for each frequency partition are determined and broadcasted by ABS, with considerations including FFR pattern, cell loading and etc. More details can be referred to section 20.3.

1.1.2.1 Closed-loop Power Control (CLPC)

The CLPC compensates channel variation with power control commands from ABS. Base station measures uplink channel state information and interference information using uplink data and/or control channel transmissions and sends power control commands to AMSs while minimizing signaling overhead.

According to the power control command from ABS, AMS adjust its UL transmission power. The adjustment step of CLPC is FFS.

1.1.2.2 Coupling of Open Loop and Closed Loop Power Control

OLPC and CLPC can be combined into a unified power control procedure that uses both AMS measurements and ABS corrections for efficient operations. Closed loop power control is active during data and control channel transmissions. Both CLPC and OLPC could be active during data transmission. AMS could be in either CLPC or OLPC mode. The AMS could request to change the power control mode from open-loop to closed-loop and vice versa. The ABS could also send the unsolicited power control mode change command to the AMS.

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