Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**New Fast Power Control IE for CLPC**
Date Submitted	**2008-01-16**
Source(s)	Jungnam Yun E-mail: jnyun@posdata-usa.com Dongjun Lee Kukjin Song Jaemyung Jang POSDATA Co., Ltd.
Re:	IEEE802.16Rev2/D2
Abstract	Enhancement on current Closed Loop Power Control Method; overhead reduction.
Purpose	Adopt the proposed solution and incorporate it in the P802.16Rev2 draft
Notice	*This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups.* It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: <http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>. Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat>.

New Fast Power Control IE for CLPC

Jungnam Yun, Dongjun Lee, Kukjin Song, Jaemyung Jang
POSDATA Co., Ltd.

Problem Statements

For FDD mode, CLPC (closed loop power control) may have higher chance to be used than OLPC (open loop power control) due to the fact that channels for downlink and uplink are not reciprocal. For the CLPC, FPC (Fast Power Control) message and PC (Power Control) IE are widely used, and FPC message is preferred to the PC ID due to less overhead. However, FPC message still has lots of overhead because it uses 16 bits CID to identify MS and also uses 8 bits to adjust the power for each MS.

In this contribution, we propose a new IE – Fast Power Control IE, which can provide power adjustments for multiple MS with much less overhead compared to the FPC message and Power Control IE.

Overhead reduction comes from reduced CID bits with RCID and reduced power adjustment bits. In this proposal, we use only 1 bit for power adjustment. From the power control test with channel emulator, the power adjustment step with 1 dB showed as good performance as step size of 0.25 dB. Table 1 shows the test results for 0.25 dB vs. 1 dB power adjustment step size, and it shows the performance differences are very small and we cannot tell which one is better than the other from the test results.

Table 1 Performance Difference of 0.25 dB over 1 dB step size

Tx Rate [kbps]	200	400	600	800	1000	1500	2000
Throughput Difference	-0.3%	1.2%	0.8%	-0.7%	2%	0.2%	0.3%

When there exists an MS, which needs more than 1 dB power adjustment, BS can utilize the Power Control IE for the MS.

Also, like all other power control related messages and IEs, Fast Power Control IE also can be used for OLPC in setting the parameter, $Offset\_BS_{perSS}$. Corresponding text changes are also addressed in Section 2.

Text Changes

[Modify Table 368 of page 760 as follows]

Table 368 – Extended-2 UIUC code assignment for UIUC = 11

Extended-2 Type (hexadecimal)	Usage
00	CQICH Enhanced Allocation IE
01	HO Anchor Active UL-MAP IE
02	HO Active Anchor UL-MAP IE
03	Anchor BS Switch IE
04	UL Sounding Command IE
05	~~*Reserved*~~ Fast Power Control IE
06	MIMO UL Enhanced IE
07	HARQ UL MAP IE
08	HARQ ACKCH Region Allocation IE
09	MIMO UL Basic IE
0A	Mini-subchannel allocation IE
OB …0D	*Reserved*
0E	AAS SDMA UL IE
0F	Feedback Polling IE

[Add following texts at the end of 8.4.5.4.28, page 827]

8.4.5.4.29 Fast Power Control IE

When power changes for multiple SS are needed, the extended UIUC = 11 may be used with the subcode 0x05 as shown in Table 426.

The CID used in the UL-MAP IE for this IE should be a broadcasting CID.

Table 426 - Fast Power Control IE format

Syntax	Size	Notes
Fast_Power_Control_IE() {	—	—
Extended-2 UIUC	4 bits	New power control = 0x05
Length	8 bits	Length in bytes
Number of Stations	8 bits	—
Power measurement frame	8 bits	—
RCID Type	2 bits	0b00: Normal CID 0b01: RCID11 0b10: RCID7 0b11: RCID3
for (i=0; I < Number of Stations; i++)	—	—

{		
RCID_IE()	*variable*	—
Power adjust	1 bit	0b00: -1 dB 0b01: +1 dB
}	—	—
Padding	*variable*	Padding to byte; shall be set to 0
}	—	—

Number of stations

Number of CID and Power Adjust tuples contained in this message.

Power measurement frame

The 8 LSBs of the frame number in which the BS measured the power corrections referred to in the message.

[Modify line 6~10 of page 997 as follows]

Additionally, the BS controls the Offset_BS_{perSS} using PMC_RSP message (6.3.2.3.55) to override the Offset_BS_{perSS} value, or using RNG-RSP (6.3.2.3.6), Fast Power Control (FPC) message (6.3.2.3.34), Power Control IE (8.4.5.4.5), Fast Power Control IE (8.4.5.4.29) and UL-MAP Fast Tracking IE (8.4.5.4.22) to adjust the Offset_BS_{perSS} value. The accumulated power control value shall be used for Offset_BS_{perSS}.