

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Mobility Enhancements for the OFDM mode	
Date Submitted	2004-11-04	
Source(s)	Rainer Ullmann, Jonathan Labs Wavesat Inc 1375 Trans-Canada Highway Suit 300 Dorval, Quebec H9P 2W8 Canada	Voice: (514) 684-0200 Ext .321 Fax: (514) 684-0211 rullmann@wavesat.com
Re:	Call for Comments within IEEE Sponsor Ballot of IEEE P802.16e/D5	
Abstract	This document includes enhancements to the OFDM mode in P802.16e/D5 to improve performance in mobile environment and harmonize with the OFDMA mode	
Purpose	Adopt these enhancements for revision of P802.16e/D5	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) 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 and
Procedures

The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <<http://ieee802.org/16/ipr/patents/policy.html>>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <<mailto:chair@wirelessman.org>> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <<http://ieee802.org/16/ipr/patents/notices>>.

Mobility Enhancements for the OFDM mode

Rainer Ullmann

Jonathan Labs

Wavesat

1. General

The following document adopts concepts introduced for mobile enhancement in the OFDMA PHY for usage in the OFDM PHY in order to enhance the performance in mobile environment. Section 2 addresses support for fast uplink tracking and section 3 addresses missing information in the MAC CS.

2. Fast Correction of Uplink Power, Frequency and Timing

Fast uplink tracking is an extension of the Fast Power Control support defined in the 6.3.2.3.34 and 8.3.6.3.5 in IEEE P802.16-REVd/D5. This extension is proposed in order to enable fast frequency and timing correction in the uplink, and offer better tracking of the variations introduced by the mobile channel. This suggested change is aligned with the corresponding section in the OFDMA PHY 8.5.4.4.21.

The proposed changes are as follows. After Section 8.3.6.3 in P802.16e/D5 insert:

8.3.6.3.8 UL-MAP dummy IE format

[Apply the following change to Table 251 in section 8.3.6.3.8]

Extended UIUC 4 bits 0x035..0x0F

After Section 8.3.6.9 in P802.16e/D5 insert:

8.3.6.3.10 UL-MAP Fast tracking Information Element

The UL-MAP Fast tracking information element in an UL-MAP entry is used to provide fast power, time and frequency indications/corrections to MSS's that have transmitted in the previous frame.

The extended UIUC=15 shall be used for this IE with sub-code 0x04

The CID used in the Information Element shall be a broadcast CID.

Table 251b—UL fast tracking Information Element

<u>Syntax</u>	<u>Size</u>	<u>Notes</u>
<u>UL_Fast_tracking_IE() {</u>		

<u>extended UIUC</u>	<u>4 bits</u>	<u>Fast-Indication = 0x04</u>
<u>Number of Length</u>	<u>4 bits</u>	<u>Variable</u>
<u>for (i = 1; i <= n; i++) {</u>		<u>For each Fast Indication bytes 1 to n (n=Length)</u>
<u>Power correction</u>	<u>2 bits</u>	<u>Power correction indication: 00: no change; 01: +2dB; 10: -1dB; 11: -2dB</u>
<u>Frequency correction</u>	<u>4 bits</u>	<u>The correction is 0.1% of the carrier spacing multiplied by the 4-bit number interpreted as a signed integer (i.e. 1000: -8; ... 0000: 0; ... 0111: 7)</u>
<u>Time correction</u>	<u>2 bits</u>	<u>The correction is floor(2 / Fs) multiplied by: 00: 0; 01: 1; 10: -1; 11: Not used</u>
<u>}</u>		
<u>}</u>		

The UL Fast tracking IE is an optional field in the UL_MAP. When this IE is sent it provides an indication about corrections that should be applied by MSS's that have transmitted in the previous UL frame. Each indication byte shall correspond to one unicast allocation-IE that has indicated an UL burst allocation in the previous UL_MAP. The order of the indication bytes shall be the same as the order of the unicast allocation-IE in the UL-MAP.

The response time for corrections following receipt of this IE shall be equal to "Ranging Response Processing Time" as defined in 10.1

3. HO Support for OFDM PHY

Most of the changes implemented in MAC Common Part Sublayer are sufficient as is to support all HO OFDM mechanisms. However, a mobile OFDM network might consist of Multi Cell Multi Frequency Networks (i.e. each sector has different frequency allocation) or Multi Cell Single Frequency Networks (i.e. each sector uses logic subchannel of single frequency). In order to synchronize in the second type of networks the information about the subchannel index is needed. The following modifications will provide this necessary information:

For 6.3.2.3.47 Neighbor Advertisement (MOB_NBR-ADV) message

[Apply the following change to Table 106d in section 6.3.2.3.47]

Preamble Index/ Subchannel Index	8 bits	<p>The index for the PHY profile specific preamble. Preamble Index is PHY specific for SCa and OFDMA. The value of Preamble Index shall be ignored and a value of '0x00' shall be used for OFDM PHY.</p> <p>For the SCa and OFDMA PHY this parameter defines the PHY specific preamble. For the OFDM PHY the 5 LSB contain the active DL subchannel index. The 3 MSB shall be Reserved and set to '0b000'.</p>
--	--------	---

Preamble Index/ [Subchannel Index](#)

~~The index for the PHY profile specific preamble. Preamble Index is PHY specific for SCa and OFDMA. For the OFDM PHY, the value of Preamble Index shall be ignored and a value of '0x00' shall be used.~~ [For the SCa and OFDMA PHY this parameter defines the PHY specific preamble. For the OFDM PHY the 5 LSB contain the DL subchannel index \(as defined in table 211\) used in the advertised BS sector. The 3 MSB shall be Reserved and set to '0b000'.](#)

PHY Profile ID

The PHY Profile ID is the aggregate ID's including the Co-located FA Indicator bit, the FA Configuration indicator bit, Time/Frequency Synchronization Indicator, BS EIRP Indicator, DCD/UCD Reference Indicator, FA Index Indicator, and the FA (Frequency Assignment) number. For systems using OFDM/OFDMA, the bit-by-bit definition of the PHY Profile ID is shown below. ~~The ID for systems using other than OFDMA is~~ . If the Co-located FA Indicator bit is set, the following field of the NBRADV element including Preamble Index, HO Process Optimization, DCD/UCD ConfigurationChange Count, and TLV Encoded Neighbor Information may be omitted.

[Apply the following change to FA Index definition:]

PHY scope [OFDM/OFDMA](#)

[Apply the following change to Table 106f in section 6.3.2.3.47]

FFT size 3 bits 0b011: [OFDMA](#) Reserved, [OFDM 256](#)

Definition of Preamble/Subchannel Index also needed in 6.3.2.3.51 BS HO Request (MOB_BSHO-REQ) message

[Apply the following change to Table 106j in section 6.3.2.3.51]

Preamble Index/ Subchannel Index	8 bits	<p>The index for the PHY profile specific preamble. Preamble Index is PHY specific for SCa and OFDMA. The value of Preamble Index shall be ignored and a value of '0x00' shall be used for OFDM PHY.</p> <p><u>For the SCa and OFDMA PHY this parameter defines the PHY specific preamble for the Neighbor BS. For the OFDM PHY the 5 LSB contain the active DL subchannel index for the Neighbor BS. The 3 MSB shall be Reserved and set to '0b000'.</u></p>
--	---------------	--

Preamble Index/ [Subchannel Index](#)

~~The index for the PHY profile specific for the Neighbor BS. Preamble Index is PHY specific for SCa and OFDMA. For the OFDM PHY, the value of Preamble Index shall be ignored and a value of '0x00' shall be used.~~ For the SCa and OFDMA PHY this parameter defines the PHY specific preamble for the Neighbor BS. For the OFDM PHY the 5 LSB contain the DL subchannel index (as defined in table 211) used in the Neighbor BS' sector. The 3 MSB shall be Reserved and set to '0b000'.

Definition of Preamble/Subchannel Index also needed in 6.3.2.3.52 MSS HO Request (MOB-MSSHO-REQ) message and in 6.3.2.3.53 BS HO Response (MOB-BSHO-RSP) message:

[Apply the following change to Tables 106k and 106l]

Preamble Index/ Preamble Present & Subchannel Index	8 bits	<p><u>For the SCa and OFDMA PHY this parameter defines the PHY specific preamble for the Neighbor BS. For the OFDM PHY the 5 LSB contain the active DL subchannel index for the Neighbor BS. The 3 MSB shall be Reserved and set to '0b000'.</u></p>
---	---------------	--

Preamble Index/ [Subchannel Index](#)

~~The index for the PHY profile specific preamble for the Neighbor BS. Preamble Index is PHY specific for SCa and OFDMA. For the OFDM PHY, the value of Preamble Index shall be ignored and a value of '0x00' shall be used.~~ For the SCa and OFDMA PHY this parameter defines the PHY specific preamble for the Neighbor BS. For the OFDM PHY the 5 LSB contain the DL subchannel index (as defined in table 211) used in the Neighbor BS' sector. The 3 MSB shall be Reserved and set to '0b000'.

Definition of Preamble/Preamble Present & Subchannel Index also needed in 6.3.2.3.54 HO Indication (MOB-HO-IND) message

[Apply the following change to Tables 106m]

Preamble Index/ <u>Subchannel Index</u>	8 bits	<u>For the SCa and OFDMA PHY this parameter defines the PHY specific preamble for the Target BS. For the OFDM PHY the 5 LSB contain the active DL subchannel index for the Target BS. The 3 MSB shall be Reserved and set to '0b000'.</u>
---	---------------	---

Preamble Index/ Subchannel Index

~~The index for the PHY profile specific preamble for the Target BS. Preamble Index is PHY specific for SCa and OFDMA. For the OFDM PHY, the value of Preamble Index shall be ignored and a value of '0x00' shall be used.~~ For the SCa and OFDMA PHY this parameter defines the PHY specific preamble for the Target BS. For the OFDM PHY the 5 LSB contain the DL subchannel index (as defined in table 211) used in the Trget BS' sector . The 3 MSB shall be Reserved and set to '0b000'.