Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Transmission Convergence Sublayer to the OFDM PHY**
Date Submitted	**2004-04-15**

Source(s)	Lei Wang Wi-LAN Inc. 2891 Sunridge Way, NE Calgary, AB, Canada, T1Y 7K7	Voice: (403)273-9133 Fax: (403)273-5100 Email: LeiW@wi-lan.com

Re:	This is a contribution to IEEE 802.16-REVd.
Abstract	This contribution describes the proposed changes to add the Transmission Convergence sublayer to the OFDM PHY in 802.16REVd.
Purpose	To provide a quick recovery of decoding process at the receiver side in case one or more FEC codeword get corrupted.
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 (Version 1.0) <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, if there is technical justification in the opinion of the standards-developing committee and provided the IEEE receives assurance from the patent holder that it will license applicants under reasonable terms and conditions for the purpose of implementing 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:r.b.marks@ieee.org> as early as possible, in written or electronic form, of any patents (granted or under application) that may cover technology that is under consideration by or has been approved by IEEE 802.16. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

Transmission Convergence Sublayer for the OFDM PHY

Lei Wang

Wi-LAN Inc.

1. Introduction

This document proposes to introduce the Transmission Convergence Sublayer (TCS) to the OFDM PHY, as an optional mechanism to quickly recover the MAC PDU decoding from the cases of receiving one or multiple uncorrectable FEC codewords.

The Transmission Convergence sublayer is specified in the current 802.16 standard, i.e., IEEE P802.16-REVd/D4-2004, but it only applies to the WirelessMAN-SC PHY.

2. References

[16REVd/D4] IEEE P802.16-REVd/D4-2004

3. Rationale

The Transmission Convergence Sublayer (TCS) specifies how to fit the MAC PDUs into the PHY FEC codewords. For a given PHY burst, the TCS PDU has a fixed size that is the codeword size of the burst.

The TCS PDU format is illustrated on page 291, Figure 139, in [16REVd/D4], which is also shown as follows:

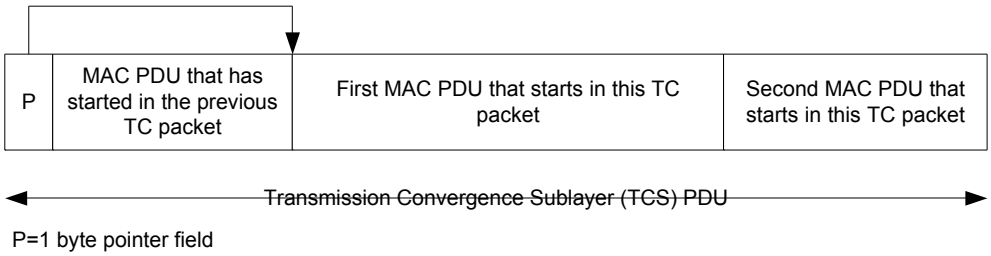

Figure 1. TCS PDU Format

A TCS PDU consists of a pointer field called P and the data from its upper layer, i.e., the MAC. The pointer field identifies the byte number in the packet which indicates either the beginning of the first MAC PDU to start in the packet or the beginning of any stuff bytes that precede the next MAC PDU. For reference, the first byte in the packet is referred to as byte number 1. If no MAC PDU or stuff bytes begin in the CS packet, then the pointer byte is set to 0. When no data is available to transmit, a stuff_byte pattern having a value (0xFF) shall be used within the payload to fill any gaps between the IEEE Std 802.16 MAC PDUs. This value is chosen as an unused value for the first byte of the IEEE Std 802.16 MAC PDU, which is designed to never have this value.

The TC sublayer enables a quick recovery from receiving one or multiple uncorrectable codeword, at the cost of using one byte per FEC codeword as the pointer field. Such a quick recovery reduces lost MAC PDUs and reduces ARQ retransmissions.

The TC sublayer can be applied to both uplink and downlink. In addition, we propose that the TC sublayer is introduced to the OFDM PHY systems as an optional mechanism, which can be enabled/disabled on per burst basis through the DIUC/UIUC definitions in the DCD/UCD messages, respectively.

4. Proposed Changes

The following changes are required in [16REVd/D4] to reflect the above proposal:

1) Page 421, line 31, insert the follow text

8.3.4 Transmission Convergence (TC) Sublayer

The transmission Convergence sublayer as described in section 8.1.4.3 is an optional mechanism for the OFDM PHY systems and can be enabled on a per-burst basis for both uplink and downlink through the DIUC/UIUC definitions in the DCD/UCD messages, respectively. The TCS_ENABLE parameter is coded as a TLV tuple as defined in 11.4.2 (i.e., DCD burst profile encodings) and 11.3.1.1 (i.e., UCD burst profile encodings).

2) Page 421, line 33, change the section number from “8.3.4” to “8.3.5”, also change all subsequent section numbers.

3) Page 588, line 43, add another row in Table 316 as follows:

Name	type	length	value
TCS_enable	153	1	=0, TCS diabled; =1, TCS enabled

4) Page 579, line 62, add another row in Table 305 as follows:

Name	type	length	value
TCS_enable	153	1	=0, TCS diabled; =1, TCS enabled