Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Corrections in the OFDM CTC definition**
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Re:	IEEE 802.16maint-04/10 (12-21-04)
Abstract	A number of modifications are presented that either clarify text or correct some errors.
Purpose	To incorporate the given tables in this contribution into IEEE 802.16maint-04/10 (12-21-04)
Notice	
Release	
Patent Policy and Procedures	

Corrections in the OFDM CTC definition

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Motivation

A few errors and inconsistencies exist in the OFDM Convolutional Turbo Code (CTC). Here we present a number of modifications that clarify text and correct some errors.

Section 8.3.3.2.3.1

Modification 1:

The first paragraph of section 8.3.3.2.3.1 should be modified as follows (additions underlined):

The bits of the data to be encoded are alternately fed to A and B, starting with the LSB ~~MSB~~ of the first byte being fed to A. The encoder is fed by blocks of k bits of N couples (k=2*N bits). For all the frame sizes k is a multiple of 8 and N is a multiple of 4. N shall be limited to: 32 < N < 4096.~~8 =< N/4 <= 1024~~ For subchannelization mode, the coding block size is limited to blocks at least 48 couples (96 bits)~~bits~~ in length, and no more than 512 couples (1024 bits) in length. In addition, k cannot be a multiple of 7.

Comment:

The original text specified N/4 must be between 8 and 1024. This definition is difficult to read (which probably led to the error discussed below) and we proposed changing it to 32 =< N <= 4096.

Once it is clear that N must be between 32 and 4096, we see that the next rule that allows the coding bock to be as small as 48 bits (which corresponds to N < 24) violates the first rule. Thus we submit that the block size should be limited to 48 couples, which corresponds to 96 bits.

Modification 2:

Table 220 should be updated as follows:

N	k	R	Modulation	Encoded Couples	Encoded Bits	NSubs	P0
48	96	1/2	QPSK	96	192	<= 8	7
64	128	2/3	QPSK	96	192	<= 8	11
72	144	3/4	QPSK	96	192	<= 8	17
96	192	1/2	QPSK	192	384	16	7
128	256	2/3	QPSK	192	384	16	11
144	288	3/4	QPSK	288	576	16	17
48	96	1/2	16QAM	96	192	<= 4	~~11~~7
72	144	3/4	16QAM	96	192	<= 4	~~13~~17
96	192	1/2	16QAM	192	384	8	~~11~~7
144	288	3/4	16QAM	288	576	8	~~13~~17
192	384	1/2	16QAM	384	768	16	11
288	576	3/4	16QAM	384	768	16	13
64	128	2/3	64QAM	96	192	<= 2	~~17~~11
72	144	3/4	64QAM	96	192	<= 2	17
128	256	2/3	64QAM	192	384	4	~~17~~11
144	288	3/4	64QAM	192	384	4	17
256	512	2/3	64QAM	384	768	8	17
288	576	3/4	64QAM	384	768	8	~~17~~13
384	768	2/3	64QAM	576	1152	16	17
432	864	3/4	64QAM	576	1152	16	17

Comment:

Certain frame sizes were added implicitly with the extension of the Turbo Code frame sizes to support subchannelization. In some cases, these frame sizes duplicated frame sizes already defined in other modulation-scheme-code-rate combinations, but defined different P0 values. The interleaver parameters should be identical for the same frame size regardless of modulation schemes. The updated table preserves the interleaver for the same frame size.

Additionally, the updated table makes the total set of supported frame sizes more clear by calling them out specifically, rather than defining them implicitly based on the Nsub parameters.

Finally, the addition of the subchannelization frame sizes introduced a frame size (N=72) that is not supported using the OFDM interleaver definition. Unique P1, P2 and P3 parameters must be defined for N=72. (See additional edit below.)

Modification 3:

Last paragraph of Section 8.3.3.2.3.1 (right below Table 220) should be modified as follows:

In Table 220, Nsub denotes the number of subchannels of the allocation in which the encoded data will be transmitted. The data block sizes (in bytes per OFDM symbol) may be calculated as N/4. Further, P1 = 3N/4, P2 = N/4 and P3 = N/2 except in the case of N=72 where P1=74, P2=72 and P3 = 2;

Comment:

This just corrects an error introduces by the subchannelization frame size extension.

Modification 4:

Section 8.3.3.2.3.2: CTC Interleaver

Step 2 should be modified as follows:

case 0: i = (P0*j + 1) mod N

case 1: i = (P0*j + N/2 + 1+P1) mod N

case 2: i = (P0*j + 1+P2) mod N

case 3: i = (P0*j + N/2 + 1+P3) mod N

Comment:

This corrects a mistake in the previous formula. It also makes it easier to understand and compare with regard to the OFDMA Turbo Code.