TSG-RAN Working Group1 meeting #6 *TSGR1#6(99)889*
Espoo, Finland, July 13-16, 1999

Source: Siemens

Title: **Text proposal regarding TFCI coding for TDD**

Document for: Decision

Abstract

At the last WG1 meeting some changes regarding the TFCI-coding for TDD were approved according to [1]. However, it was agreed that additional simulation had to be performed considering a fading channel. Now, these results are available which clearly prove the expected performance [2]. With the proposed combining of two successive TFCI-words in the receiver a sufficiently low BER for the TFCI can be achieved.

Moreover, to align the TFCI-coding with the respective coding schemes for FDD, we propose to apply additional repetition for the TFCI-bits in case of lowest BER (10e-6). For the same reason, the interleaving of TFCI words over successive frames, which was an optional part of the original proposal, is omitted.

These changes are reflected in the following text proposal

Proposed Text

All proposed changes with respect to the current text in [3] are highlighted with revision marks below.

6.3 Coding for layer 1 control

6.3.1 Coding of transport format combination indicator (TFCI)

~~*<Editor's note:.This text was updated to reflect TDD specific interleaving.>*~~

~~*<WG1 Note: Conforming simulation results should be given.>*~~
The number of TFCI bits is variable and is set at the beginning of the call via higher layer signalling. Encoding of the TFCI bits depends on the number of them. If there are at most 6 bits of TFCI the channel encoding is done as described in section 6.3.1.1. Correspondingly, if the TFCI word is extended to 7-10 bits the channel encoding is done as explained in the section 6.3.1.2. Also specific coding of less than 6 bits is possible as explained in 6.3.1.3 ~~When decoding, default TFCI words are assumed.~~ For improved TFCI detection reliability repetition is used to increase the number of TFCI bits. Additionally, with any TFCI coding scheme it is assumed that in the receiver combining of two successive TFCI words will be performed if the shortest transmission time interval of any TrCH is at least 20 ms.

6.3.1.1 Default TFCI word

If the number of TFCI bits is 6 a biorthogonal (32, 6) block code is used. The code words of the biorthogonal (32, 6) code are from two mutually biorthogonal sets, $S_{C_5} = \{C_5(0), C_5(1),..., C_5(31)\}$ and its binary complement, $\bar{S}_{C_5} = \{\bar{C}_5(0), \bar{C}_5(1),..., \bar{C}_5(31)\}$. Words of set S_{C5} are from the level 5 of the code three, which is generated, using the short code generation method defined in chapter 6.2 of 25.213. The mapping of information bits to code words is shown in the Table 6.3.1-1.

Table 6.3.1- 1 Mapping of information bits to code words for biorthogonal (32, 6) code.

Information bits	Code word
000000	$C_5(0)$
000001	$\overline{C_5(0)}$
000010	$C_5(1)$
...	...
111101	$\overline{C_5(30)}$
111110	$C_5(31)$
111111	$\overline{C_5(31)}$

6.3.1.2 Extended TFCI word

If the number of TFCI bits is 7-10 the TFCI information field is split into two words of length 5 bits as shown in the following formula:

$n := \left\lfloor \sqrt{TFCI} \right\rfloor$; n is the largest integer being smaller than or equal to the square root of the transmitted TFCI value.

if $TFCI < n^2 + n$

then $Word1 := n$; $Word2 := TFCI - n^2$

else $Word2 := n$; $Word1 := n^2 + 2n - TFCI$

Both of the words are encoded using biorthogonal (16, 5) block code. The code words of the biorthogonal (16, 5) code are from two mutually biorthogonal sets, $S_{C_4} = \{C_4(0), C_4(1), \ldots, C_4(15)\}$ and its binary complement, $\overline{S}_{C_4} = \{\overline{C}_4(0), \overline{C}_4(1), \ldots, \overline{C}_4(15)\}$. Words of set S_{C_4} are from the level 4 of the code three, which is generated, using the short code generation method defined in chapter 3.2.4.2.2.1.1.1. The mapping of information bits to code words is shown in theTable 6.3.1-2.

Table 6.3.1- 2 Mapping of information bits to code words for biorthogonal (16, 5) code.

Information bits	Code word
00000	$C_4(0)$
00001	$\overline{C_4(0)}$
00010	$C_4(1)$
...	...
11101	$\overline{C_4(14)}$
11110	$C_4(15)$
11111	$\overline{C_4(15)}$

6.3.1.3 Coding of short TFCI lengths

If the number of TFCI bits is 1 or 2, then repetition will be used for coding. In this case each bit is repeated 3 times giving 4-bit transmission for a single TFCI bit and 8-bit transmission for 2 TFCI bits.

If the number of TFCI bits is in the range of 3 to 5, then one word of the biorthogonal (16,5) block code, as described in section 6.3.1.2, will be used.

~~6.3.1.4 Interleaving of TFCI~~

~~In the case of the shortest Transmission Time Interval is 20 ms or above, the redundant TFCI information should be combined in the receiver and may be interleaved over two slots, spaced by a single frame.~~

~~The details of the interleaving scheme are FFS.~~

Conclusion

The text proposal in the last section, which was updated according to the simulations results provided in [2], should be approved for [3].

References

[1] 3GPP TSGR1#5 (99)611, 'TFCI Coding Proposal for UTRA TDD', Source: Siemens
[2] 3GPP TSGR1#6 (99)865, 'Simulation results of TFCI coding performance for TDD', Source Siemens
[3] 3GPP TS 25.222, 'Multiplexing and channel coding (TDD)', Source: Editor