Agenda Item: 1.28 Mcps TDD

Source: Samsung Electronics Co., Ltd.

Title: Revision of "Correction of the Mapping of TFCI Code Word for Very Short TFCI for 8PSK"

Document for: Approval

Remarks

During the 1.28 Mcps TDD Ad Hoc meeting held on Jan. 17th, 2001, R1-01-0075 "Correction of the Mapping of TFCI Code Word for Very Short TFCI for 8PSK" was presented, and the contents were agreed upon. However, a revision was need because there were an editorial error and some comments that the terminalogy used might be confusing.

In this contribution, the text proposal is corrected according to the comments. The corrections made are

1. In section 4.4.2.3, "When the number of bits in the TFCI code word is 8," is replaced by "When the number of bits in the TFCI code word is 6 ,"

2. "TFCI information bits" is replaced by "TFCI bits", where "TFCI bits" means the TFCI bits *before* TFCI coding.

3. "TFCI word" is replaced by "TFCI code word", where "TFCI code word" means the *output sequence* of the TFCI encoder.

The revision marks in the text proposal represents (1) the original correction/addition of text made in R1-01-0075, and (2) the changes/correction in this revision.

------------------------------- Beginning of the proposed correction for Working CR to TS 25.222 -------------------------

4.4.2   Coding of transport format combination indicator (TFCI) for 8PSK

Encoding of TFCI bits depends on the number of them and the modulation in use. When 2 Mcps service is transmitted, 8PSK modulation is applied in 1.28 Mcps TDD option. The coding scheme for TFCI when the number of bits are 6 – 10, and less than 6 are described in section 4.4.2.1 and 4.4.2.2, respectively.

4.4.2.1   Coding of long TFCI lengths

When the number of TFCI bits are 6 – 10, the TFCI bits are encoded by using a (64,10) sub-code of the second order Reed-Muller code, then 16 bits out of 64 bits are punctured (Puncturing positions are 0, 4, 8, 13, 16, 20, 27, 31, 34, 38, 41, 44, 50, 54, 57, 61st bits). The coding procedure is shown in Figure [F1].
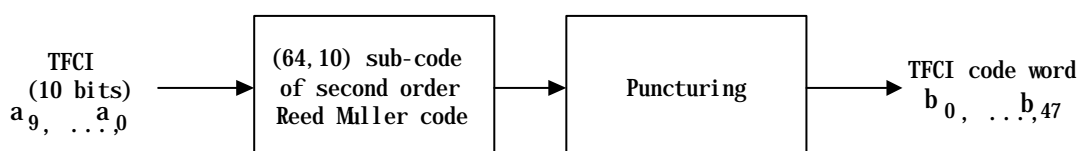
Figure [F1]: Channel coding of long TFCI bits for 8PSK

The code words of the punctured (48,10) sub-code of the second order Reed-Muller codes are linear combination of 10 basis sequences. The basis sequences are shown in Table [T1].

Table [T1]: Basis sequences for (48,10) TFCI code

I	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	$M_{i,4}$	$M_{i,5}$	$M_{i,6}$	$M_{i,7}$	$M_{i,8}$	$M_{i,9}$
0	1	0	0	0	0	0	1	0	1	0
1	0	1	0	0	0	0	1	1	0	0
2	1	1	0	0	0	0	1	1	0	1
3	1	0	1	0	0	0	1	1	1	0
4	0	1	1	0	0	0	1	0	1	0
5	1	1	1	0	0	0	1	1	1	0
6	1	0	0	1	0	0	1	1	1	1
7	0	1	0	1	0	0	1	1	0	1
8	1	1	0	1	0	0	1	0	1	0
9	0	0	1	1	0	0	1	1	0	0
10	0	1	1	1	0	0	1	1	0	1
11	1	1	1	1	0	0	1	1	1	1
12	1	0	0	0	1	0	1	0	1	1
13	0	1	0	0	1	0	1	1	1	0
14	1	1	0	0	1	0	1	0	0	1
15	1	0	1	0	1	0	1	0	1	1
16	0	1	1	0	1	0	1	1	0	0
17	1	1	1	0	1	0	1	1	1	0
18	0	0	0	1	1	0	1	0	0	1
19	1	0	0	1	1	0	1	0	1	1
20	0	1	0	1	1	0	1	0	1	0
21	0	0	1	1	1	0	1	0	1	0
22	1	0	1	1	1	0	1	1	0	1
23	0	1	1	1	1	0	1	1	1	0
24	0	0	0	0	0	1	1	1	0	1
25	1	0	0	0	0	1	1	1	1	0
26	1	1	0	0	0	1	1	1	1	1
27	0	0	1	0	0	1	1	0	1	1
28	1	0	1	0	0	1	1	1	0	1
29	1	1	1	0	0	1	1	0	1	1
30	0	0	0	1	0	1	1	0	0	1
31	0	1	0	1	0	1	1	0	0	1
32	1	1	0	1	0	1	1	1	1	1
33	1	0	1	1	0	1	1	0	0	1
34	0	1	1	1	0	1	1	1	1	0
35	1	1	1	1	0	1	1	1	0	1
36	0	0	0	0	1	1	1	1	1	0
37	1	0	0	0	1	1	1	0	1	1
38	1	1	0	0	1	1	1	1	1	1
39	0	0	1	0	1	1	1	1	0	0
40	1	0	1	0	1	1	1	1	0	0
41	1	1	1	0	1	1	1	1	1	1
42	0	0	0	1	1	1	1	1	1	1
43	0	1	0	1	1	1	1	0	1	0
44	1	1	0	1	1	1	1	0	1	0
45	0	0	1	1	1	1	1	0	1	1
46	0	1	1	1	1	1	1	0	0	1
47	1	1	1	1	1	1	1	1	0	0

Let's define the TFCI ~~information~~ bits as a_0 , a_1 , a_2 , a_3 , a_4 , a_5 , a_6 , a_7 , a_8 , a_9, where a_0 is the LSB and a_9 is the MSB. The TFCI ~~information~~ bits shall correspond to the TFC index (expressed in unsigned binary form) defined by the RRC layer to reference the TFC of the CCTrCH in the associated DPCH radio frame.

The output code word bits b_i are given by:

$$b_i = \sum_{n=0}^{9} (a_n \times M_{i,n}) \bmod 2$$

where i=0...47. N_{TFCI}=48.

4.4.2.2   Coding of short TFCI lengths

4.4.2.2.1   Coding very short TFCIs by repetition

When the number of TFCI bits is 1 or 2, then repetition will be used for the coding. In this case, each bit is repeated to a total of 6 times giving 6-bit transmission ($N_{TFCI} = 6$) for a single TFCI bit and 12-bit transmission ($N_{TFCI} = 12$) for 2 TFCI bits. For a single TFCI bit b_0, the TFCI code word shall be $\{b_0, b_0, b_0, b_0, b_0, b_0\}$. For TFCI bits b_0 and b_1, the TFCI code word shall be $\{b_0, b_1, b_0, b_1, b_0, b_1, b_0, b_1, b_0, b_1, b_0, b_1\}$.

4.4.2.2.2   Coding short TFCIs using bi-orthogonal codes

If the number of TFCI bits ~~are~~ is in the range of 3 to 5, the TFCI bits are encoded using a (32,5) first order Reed-Muller code, then 8 bits out of 32 bits are punctured (Puncturing positions are 0, 1, 2, 3, 4, 5, 6, 7th bits). The coding procedure is shown in Figure [F2].
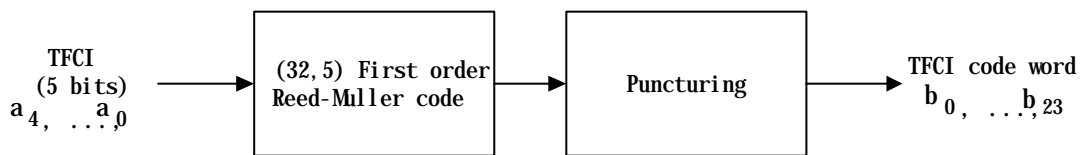

Figure [F2]: Channel coding of short TFCI bits for 8PSK

The code words of the punctured (32,5) first order Reed-Muller codes are linear combination of 5 basis sequences shown in Table [T2].

Table [T2]: Basis sequences for (24,5) TFCI code

I	$M_{i,0}$	$M_{i,1}$	$M_{i,2}$	$M_{i,3}$	$M_{i,4}$
0	0	0	0	1	0
1	1	0	0	1	0
2	0	1	0	1	0
3	1	1	0	1	0
4	0	0	1	1	0
5	1	0	1	1	0
6	0	1	1	1	0
7	1	1	1	1	0
8	0	0	0	0	1
9	1	0	0	0	1
10	0	1	0	0	1
11	1	1	0	0	1
12	0	0	1	0	1
13	1	0	1	0	1
14	0	1	1	0	1
15	1	1	1	0	1
16	0	0	0	1	1

17	1	0	0	1	1
18	0	1	0	1	1
19	1	1	0	1	1
20	0	0	1	1	1
21	1	0	1	1	1
22	0	1	1	1	1
23	1	1	1	1	1

Let's define the TFCI ~~information~~ bits as a_0 , a_1 , a_2 , a_3 , a_4, where a_0 is the LSB and a_4 is the MSB. The TFCI ~~information~~ bits shall correspond to the TFC index (expressed in unsigned binary form) defined by the RRC layer to reference the TFC of the CCTrCH in the associated DPCH radio frame.

The output code word bits b_i are given by:

$$b_i = \sum_{n=0}^{4} (a_n \times M_{i,n}) \bmod 2$$

where i=0…23. N_{TFCI}=24.

4.4.2.3 Mapping of TFCI code word

Denote the number of bits in the TFCI code word by N_{TFCI}, and denote the TFCI code word bits by b_k, where $k = 0, …, N_{TFCI}-1$.

When the number of bits in the TFCI code word is 12, 24, or 48, ~~The~~ the mapping of the TFCI code word to the TFCI bit positions in a time slot shall be as follows.
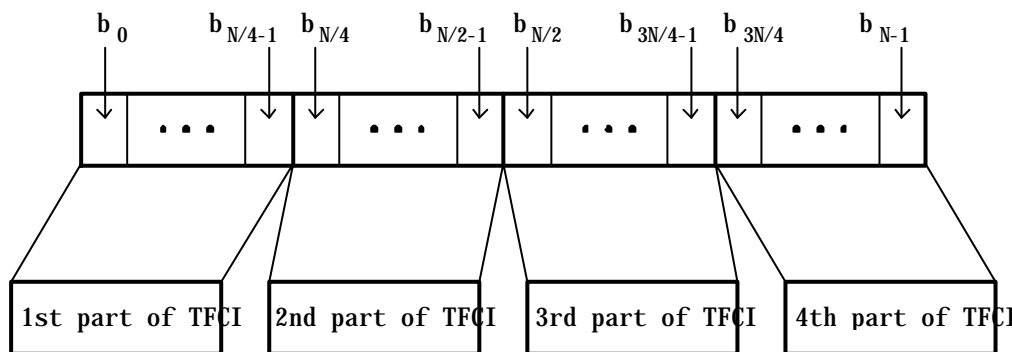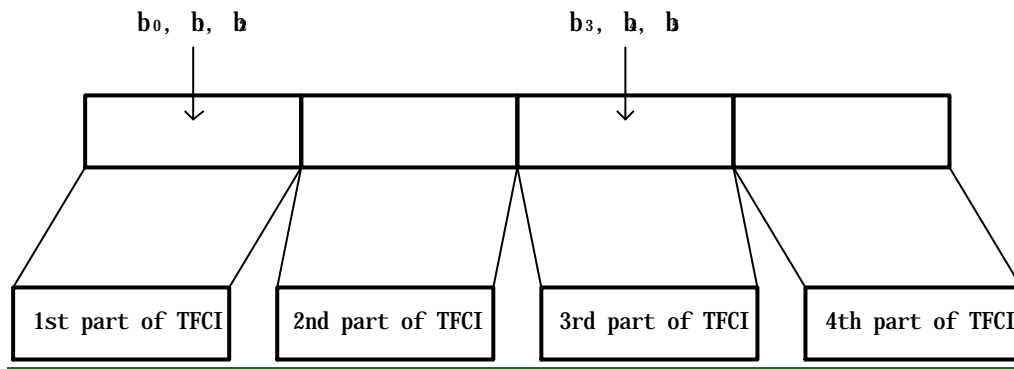

Figure [F3]: Mapping of TFCI code word bits to timeslot in 1.28 Mcps TDD option, where N = N_{TFCI}.

When the number of bits in the TFCI code word is 6, the TFCI code word is equally divided into two parts for the consequtive two sub-frames and mapped onto the first data field in each of the consecutive sub-frames. The mapping of the TFCI code word to the TFCI bit positions in a time slot shall be as shown in figure [F4].

$b_0, \ b_1, \ b_2$ $\quad\quad\quad\quad\quad\quad\quad$ $b_3, \ b_4, \ b_5$

| 1st part of TFCI | 2nd part of TFCI | 3rd part of TFCI | 4th part of TFCI |

Figure [F4]: Mapping of TFCI code word bits to timeslot in 1.28 Mcps TDD option when $N_{TFCL} = 6$

The location of the 1st to 4th parts of TFCI in the timeslot is defined in [7].