3GPP TSG-RAN Working Group 1 Meeting No. 9
November 30th – December 3rd 1999, Dresden, Germany

Agenda Item:	Ad Hoc 1
Source:	Nokia
Title:	Modified Physical Channel Mapping for Multi-code transmission in TDD mode
Document for:	Approval

Introduction

In order to support multi-code transmission in TDD the current physical channel mapping after the 2nd interleaving scheme has to be adjusted for optimal bit separation. With the current scheme only in the single code case the bits will have maximum distance with interleaving. In UTRA TDD due to the large variance in the interference in time domain it is important to maintain the maximum separation between the bits, because in the case of uplink/downlink interference there could be a situation where a part of a slot could be wiped out. If the bits from the parallel codes are not maximally separated in time domain this could result in an error burst being input to the channel decoder.

This contribution proposes simple corrections to the physical channel mapping with multi-code transmission to avoid the problem.

Principle of the new scheme

According to current TDD specification (TS25.222), the second interleaving scheme combined with the physical channel mapping follows a simple rule by which in case of parallel codes the bits that should be separated by the interleaving are mapped on top of each other. This is illustrated in Figure2 in the part headed: "Multi-code Tx current". As was already mentioned before due to the uplink/downlink interference in UTRA TDD it is important that these bits are not mapped on top of each other. In the case that a part of a time slot (begging/end) is lost such a bit mapping scheme would result in an input error burst to the channel decoder most likely.

In this context, we propose to use a simple scheme to overcome this problem. The following would be applicable in the case of multi-code transmission in UTRA TDD. The new scheme would simply perform a bit order reversal of the bits to be mapped on the second code. Since in TDD there are up to 9 codes to be transmitted the scheme would in this case invert the bit order on every second code. The case with two parallel codes is also illustrated in Figure2 in the part headed: "Multi-code Tx modified". The proposed scheme is a generic solution for Multi-code transmission in all specified cases with UTRA TDD.

The new scheme does not include major complexity issues either, since only a bit order reversal is introduced for part of the data.

Results

The proposed scheme was simulated and the gain to the current scheme is obvious from the Figure1. The simulation was a simple example to demonstrate the tolerance to losing one or more consecutive bits (symbols) from the beginning of the burst. This was performed both with and without the modification. The simulation set-up was corresponding to a spreading factor of 16 and two parallel codes. It should be noted that the presented performance is at 1/3 rate coding and that further deterioration can be expected as the code rate goes down (1/2). The simulation parameters were the following:

- 10ms Interleaving
- 1/3 Rate convolutional coding
- No of frames: 10000
- AWGN channel
- SNR set to 0dB

Text proposal

In the text as given below required changes for physical channel mapping scheme are made to accommodate the possibility of using multi-code transmission in TDD. The changes apply to specification document TS25.222.

Conclusion

We propose to adopt the text from beyond to the specification document TS 25.222.

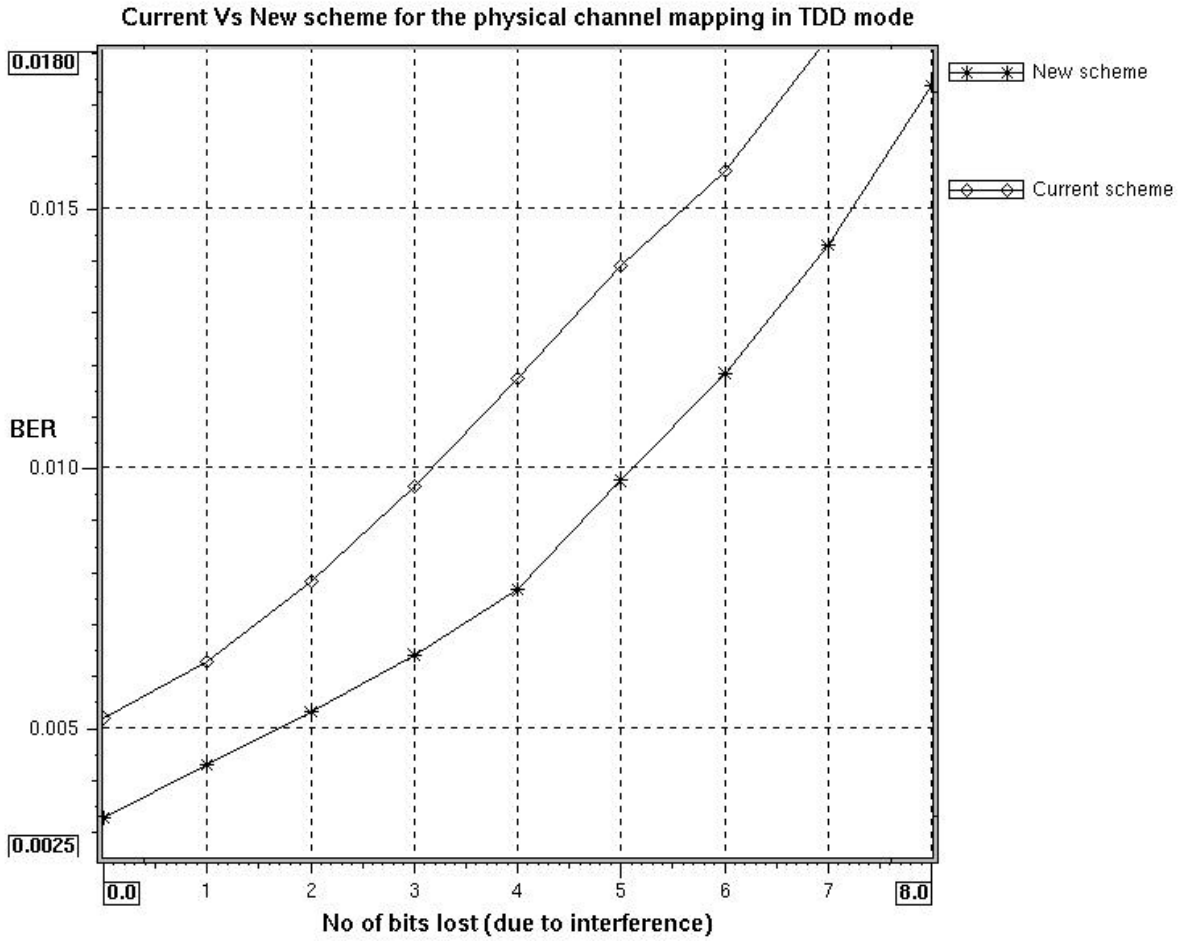

Figure 1: Simulation resluts

References

[1] 3GPP TS25.222 "Multiplexing and channel coding TDD"

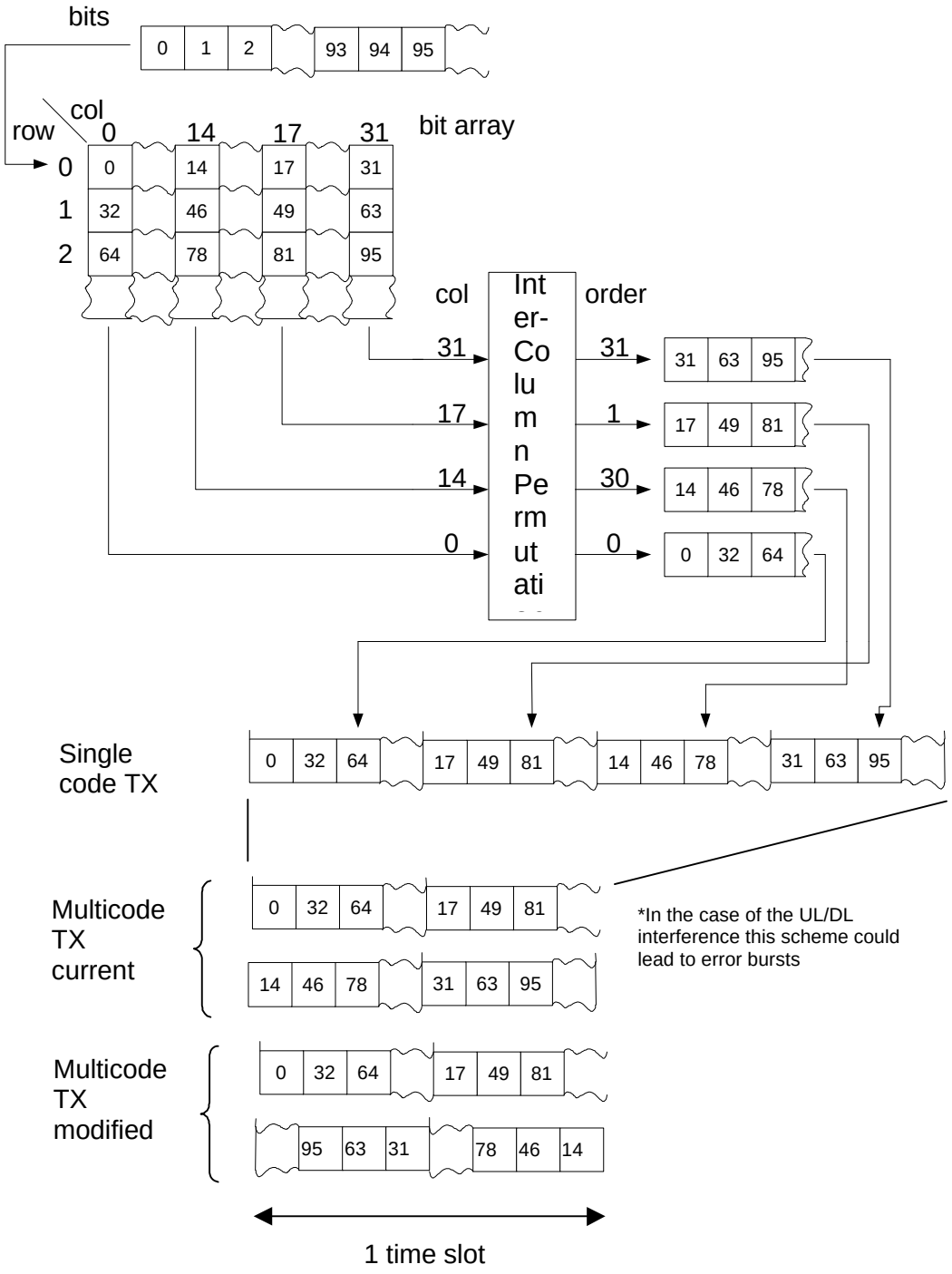

Figure 2: Modified physical channel mapping principle

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Document R1-99j57
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.222	CR	009	Current Version:	V3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG RAN #6	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form :* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio	X	Core Network	

Source:	Nokia		**Date:**	19 Nov 1999	
Subject:	Modified physical channel mapping scheme				
Work item:	TS25.222				

Category: *(only one category shall be marked with an X)*			**Release:**		
	F	Correction		Phase 2	
	A	Corresponds to a correction in an earlier release		Release 96	
	B	Addition of feature		Release 97	
	C	Functional modification of feature	X	Release 98	
	D	Editorial modification		Release 99	X
				Release 00	

Reason for change:	The current physical channel mapping scheme does not support the multi-code transmission optimally
Clauses affected:	6.2.11.1, 6.2.11.2

Other specs affected:			
Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:	

help.doc

<--------- double-click here for help and instructions on how to create a CR.

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6.2.11 Physical channel mapping

The PhCH for both uplink and downlink is defined in [6]. The bits after physical channel mapping are denoted by $w_{p1}, w_{p2}, \ldots, w_{pU_p}$, where p is the PhCH number and U_p is the number of bits in one radio frame for the respective PhCH. The bits w_{pk} are mapped to the PhCHs so that the bits for each PhCH are transmitted over the air in ascending order with respect to k. The mapping scheme depends on the applied 2nd interleaving scheme.

6.2.11.1 Mapping scheme after frame related 2nd interleaving

The following mapping rule is applied:

Bits on first PhCH after physical channel mapping:

$w_{1k} = v_k$ $\quad k = 1, 2, \ldots, U_1$

Bits on second PhCH after physical channel mapping:

$w_{2k} = v_{(k+U_1)}$ $\quad k =$ $U_2, U_2\text{-}1, \ldots\ldots 1$~~1, 2 , …, U_2~~

…

Bits on the odd numbered P^{th} PhCH after physical channel mapping (P = 1, 3, 5, …..):

$w_{Pk} = v_{(k+U_1+\ldots+U_{P-1})}$ $\quad k = 1, 2, \ldots, U_P$

Bits on the even numbered P^{th} PhCH after physical channel mapping (P = 2, 4, 6, …..):

$w_{Pk} = v_{(k+U_1+\ldots+U_{P-1})}$ $\quad k = U_P\text{-}1, U_P\text{-}2, \ldots, 1$

6.2.11.2 Mapping scheme after timeslot related 2nd interleaving

For each timeslot only those physical channels with $p = 1, 2, \ldots, P_t$ are considered respectively, which are transmitted in that timeslot, and the following mapping scheme is applied:

Bits on first PhCH in timeslot t after physical channel mapping:

$w_{1k} = v_{tk}$ $\quad k = 1, 2, \ldots, U_1$

Bits on second PhCH in timeslot t after physical channel mapping:

$w_{2k} = v_{t(k+U_1)}$ $\quad k =$ $U_2, U_2\text{-}1, \ldots\ldots 1$~~1, 2 , …, U_2~~

…

Bits on the odd numbered PhCH P_t in timeslot t after physical channel mapping (P = 1, 3, 5, …..):

$w_{P_t k} = v_{t(k+U_1+\ldots+U_{P_t-1})}$ $\quad k = 1, 2, \ldots, U_{P_t}$

Bits on the even numbered P^{th} PhCH P_t in timeslot t after physical channel mapping (P = 2, 4, 6, …..):

$w_{Pk} = v_{t(k+U_1+\ldots+U_{P-1})}$ $\quad k = U_P\text{-}1, U_P\text{-}2, \ldots, 1$

Note: t subscript has also been added for the last two equations.