TSG RAN Working Group 1 (Radio layer 1) ***TSGR1#10 (00) 0153***
Beijing (China), 18-21 January 2000

Agenda Item:	Ad-hoc 5
Source:	Alcatel
Title:	CR 25.212-043 and CR 25.222-020: Improvement of convolutional coding scheme for very low code block sizes
Document for:	Decision

Introduction

A slight modification of the current convolutional coding scheme was proposed in [1] to improve it for very low code block sizes (< 10 bits). This contribution includes the related CRs for 25.212 and 25.222.

References

[1] 3GPP R1-00-0095, “Improvement of convolutional coding scheme for very low code block size”, January 2000, Alcatel

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25.212	CR	043	Current Version:	3.1.0

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

For submission to: TSG-RAN #7 *List expected approval meeting # here ↑*

for approval [X] for information [ ]

strategic [ ] non-strategic [ ] *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: 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: Alcatel **Date:** 2000-01-18

Subject: Improvement of convolutional coding for low code block sizes

Work item:

Category: *(only one category Shall be marked With an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	X
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: The current convolutional coding included in the specifications is not well adapted for low code block sizes. This CR proposes to slightly modify it in order to improve it for low code block sizes (by decreasing the number of tail bits)

Clauses affected: 4.2.3

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:

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4.2.3 Channel coding

Code blocks are delivered to the channel coding block. They are denoted by $o_{ir1}, o_{ir2}, o_{ir3}, \ldots, o_{irK_i}$, where i is the TrCH number, r is the code block number, and K_i is the number of bits in each code block. The number of code blocks on TrCH i is denoted by C_i. After encoding the bits are denoted by $y_{ir1}, y_{ir2}, y_{ir3}, \ldots, y_{irY_i}$. The encoded blocks are serially multiplexed so that the block with lowest index r is output first from the channel coding block. The bits output are denoted by $c_{i1}, c_{i2}, c_{i3}, \ldots, c_{iE_i}$, where i is the TrCH number and $E_i = C_i Y_i$. The output bits are defined by the following relations:

$c_{ik} = y_{i1k}$ $k = 1, 2, \ldots, Y_i$

$c_{ik} = y_{i,2,(k-Y_i)}$ $k = Y_i + 1, Y_i + 2, \ldots, 2Y_i$

$c_{ik} = y_{i,3,(k-2Y_i)}$ $k = 2Y_i + 1, 2Y_i + 2, \ldots, 3Y_i$

…

$c_{ik} = y_{i,C_i,(k-(C_i-1)Y_i)}$ $k = (C_i - 1)Y_i + 1, (C_i - 1)Y_i + 2, \ldots, C_i Y_i$

The relation between o_{irk} and y_{irk} and between K_i and Y_i is dependent on the channel coding scheme.

The following channel coding schemes can be applied to TrCHs:

- Convolutional coding
- Turbo coding
- No channel coding

The values of Y_i in connection with each coding scheme:

- Convolutional coding, ½ rate: $Y_i = 2$~~*(~~$K_i + N_i^{(tail)}$~~)16~~; *1/3 rate:* $Y_i = 3$~~*(~~$K_i + N_i^{(tail)}$~~)24~~
- Turbo coding, 1/3 rate: $Y_i = 3*K_i + 12$
- No channel coding, $Y_i = K_i$

where $N_i^{(tail)}$ is the number of tail bits for the convolutional coding and is defined in section 4.2.3.1.

Table 1: Error Correction Coding Parameters

Transport channel type	Coding scheme	Coding rate
BCH	Convolutional code	1/2
PCH		
RACH		
CPCH, DCH, DSCH, FACH		1/3, 1/2
	Turbo Code	1/3
	No coding	

If no code blocks are input to the channel coding ($C_i = 0$), no bits shall be output from the channel coding, i.e. $E_i = 0$.

4.2.3.1 Convolutional coding

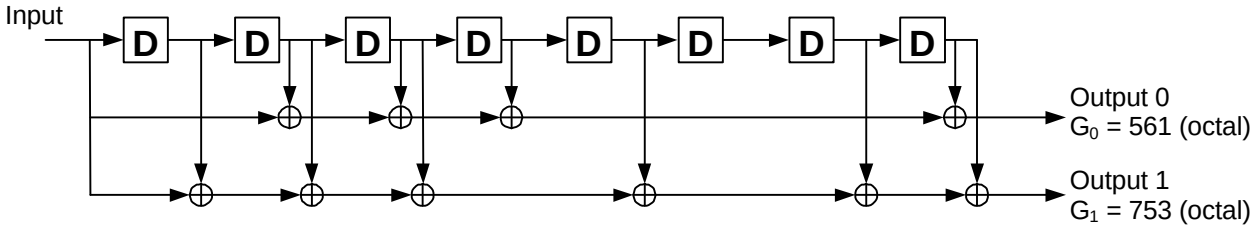
Convolutional codes with constraint length 9 and coding rates 1/3 and 1/2 are defined.

The configuration of the convolutional coder is presented in figure 3.

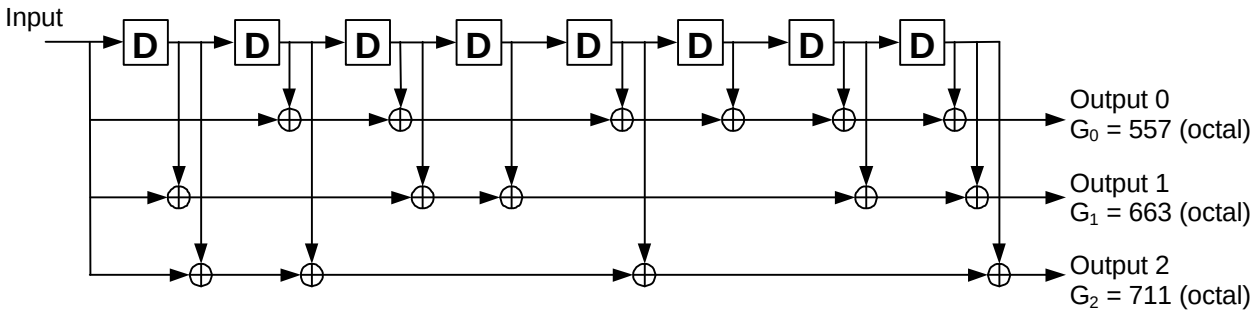
Output from the rate 1/3 convolutional coder shall be done in the order output0, output1, output2, output0, output1, output 2, output 0,…,output2. Output from the rate 1/2 convolutional coder shall be done in the order output 0, output 1, output 0, output 1, output 0, …, output 1.

~~8~~ $N_i^{(tail)}$ tail bits with binary value 0 shall be added to the end of the code block before encoding, where $N_i^{(tail)}$ is the minimum value of 8 and K_i.

The initial value of the shift register of the coder shall be "all 0" when starting to encode the input bits.



(a) Rate 1/2 convolutional coder



(b) Rate 1/3 convolutional coder

Figure 3: Rate 1/2 and rate 1/3 convolutional coders

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25.222	CR	020	Current Version:	3.1.0

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

For submission to: TSG-RAN #7 *list expected approval meeting # here ↑*

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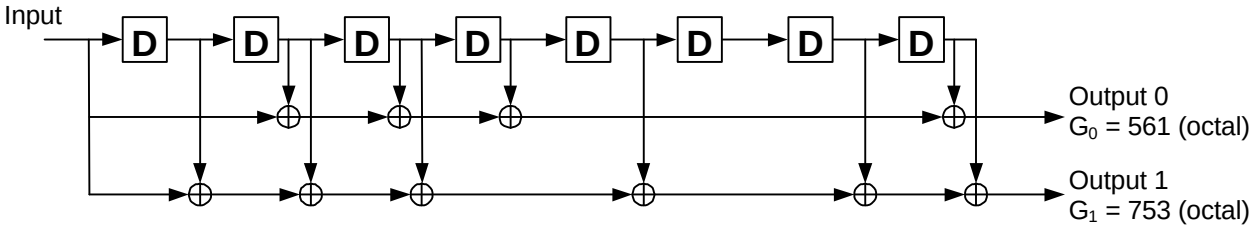
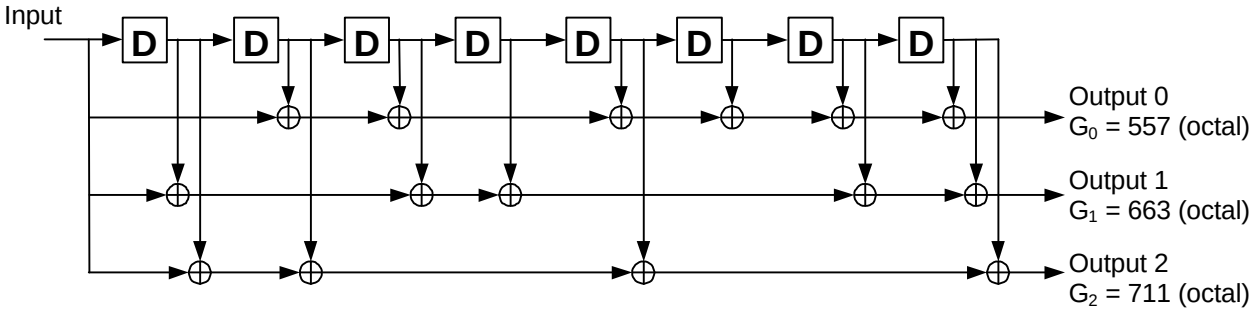


(a) Rate 1/2 convolutional coder



(b) Rate 1/3 convolutional coder

Figure 3: Rate 1/2 and rate 1/3 convolutional coders