3GPP TSG RAN WG1#9
Dresden, Germany Nov. 30th - Dec. 3rd, 1999

Document R1-99j80
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	011	Current Version:	3.0.0

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

For submission to: RAN #6 *list expected approval meeting # here ↑*

for approval	X	strategic	
for information		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: Siemens **Date:** 26.11.1999

Subject: Introduction of end puncturing to 25.222

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Tdoc R1-99J08 has shown advantages of end puncturing. In particular there is an improved performance in terms of required Eb/N0, most pronounced for short block sizes which are expected for UEP. Additionally the overhead due to padding for radio frame equalisation will be avoided.
End puncturing should therefore be introduced in the section dealing with convolutional coding.

Clauses affected: 4.2.3 and 4.1.3.1.1

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: A similar change should be introduced in 25.212 as well. The changes differ slightly, from 25.212 CR 022 because in TDD there are no fixed bit positions and radio frame equalisation will always be applied.

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 transport channels:

- Convolutional coding
- Turbo coding
- No channel coding

The values of Y_i in connection with each coding scheme:

- Convolutional coding, ½ rate: $Y_i = 2*K_i + 16 - N_{EPi}$; 1/3 rate: $Y_i = 3*K_i + 24 - N_{EPi}$
  N_{EPi} is defined in section 4.2.3.1.1.
- Turbo coding, 1/3 rate: $Y_i = 3*K_i + 12$
- No channel coding, $Y_i = K_i$

Table 4.2.3-1: Error Correction Coding Parameters

Transport channel type	Coding scheme	Coding rate
BCH	Convolutional code	1/2
PCH		
FACH		
RACH		
DCH		1/3, 1/2, or no coding
DCH	Turbo code	1/3, or no coding

4.2.3.1 Convolutional Coding

- Constraint length K=9. Coding rates 1/2 and 1/3.
- The configuration of the convolutional coder is presented in figure 4-2.

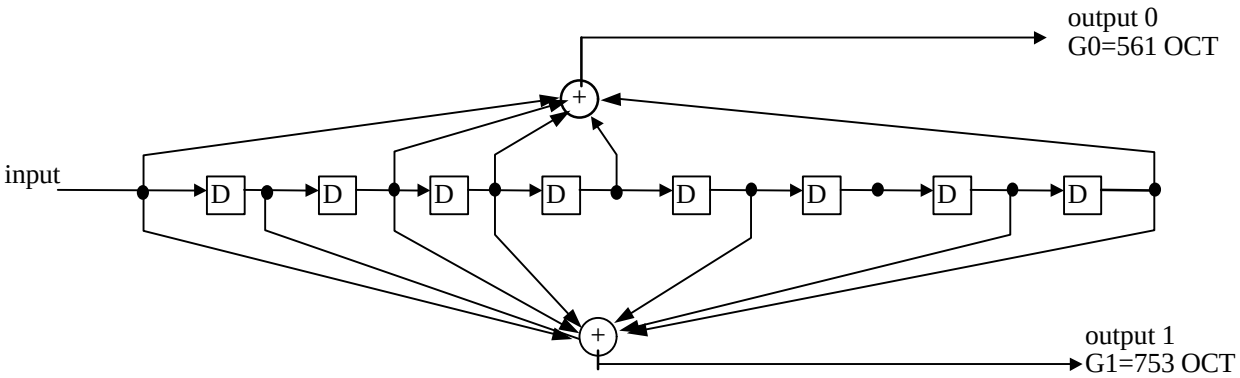
- The output from the convolutional coder shall be done in the order output0, output1,output2, output0, output1,…, output2. (When coding rate is 1/2, output is done up to output 1).
- The initial value of the shift register of the coder shall be "all 0".
- K-1 tail bits (value 0) shall be added to the end of the code block before encoding.
- If end puncturing is applied, the number of bits to be punctured (N_{EPi}) is calculated as indicated in table 2:
- The N_{EPi} bits on the first N_{EPi} positions listed in table 3 (counting from 0 for the first bit from output0) of the resulting outputstream after coding are punctured:

Table 2: Number of Bits N_{EPi} to be puncturd from End Puncturing Patterns

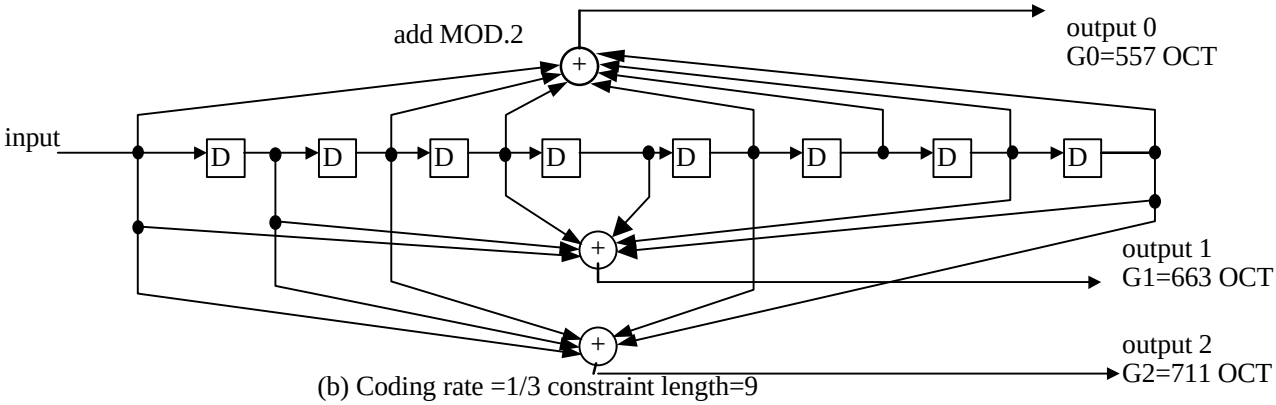
Rate 1/2		$N_{EPi} = (2*K_i + 15) \bmod F_i + 9 - F_i$
Rate 1/3	$K_i > 3$	$N_{EPi} = (3*K_i + 23) \bmod F_i + 17 - F_i$
	$K_i < 4$	$N_{EPi} = (3*K_i + 19) \bmod F_i + 13 - F_i$

Table 3: End Puncturing Patterns

Rate 1/2	2, $2*K_i$ +14, 4, $2*K_i$ +11, 8, $2*K_i$ +10, 9, $2*K_i$ + 8
Rate 1/3	0, $3*K_i$ +23, 1, $3*K_i$ +22, 3, $3*K_i$ +20, 5, $3*K_i$ +18, 7, $3*K_i$ +16, 10, $3*K_i$ +13, 13, $3*K_i$ +10, 16, $3*K_i$ + 7



(a) Coding rate =1/2 constraint length=9



(b) Coding rate =1/3 constraint length=9

Figure 4-2: Convolutional Coder

4.2.3.2 Turbo coding

4.2.3.2.1 Turbo coder

For data services requiring quality of service between 10^{-3} and 10^{-6} BER inclusive, parallel concatenated convolutional code (PCCC) with 8-state constituent encoders is used.