3GPP TSG RAN WG1 Meeting #9
Dresden, Germany, Nov 30 – Dec 3, 1999

Document R1-(99)J96
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	002	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 *list expected approval meeting # here ↑*	for approval	X	strategic		*(for SMG use only)*
	for information		non-strategic		

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: Samsung and LGIC **Date:** 12 Oct 1999

Subject: Clarification of treatment of the bits after rate matching of Turbo codes

Work item: TS25.222

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

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

Reason for change: The current description of TS25.222 is not clear for treatment of the bits after rate matching. So, some additional description is required to avoid any misunderstanding and ambiguities.

Clauses affected: 4.2.7.2 of TS25.222

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:

endif

For each radio frame, the rate-matching pattern is calculated with the algorithm in section 4.2.7.3, where:

N is as above,

$e_{ini} = (a \cdot S(n_i) \cdot |\Delta N| + N) \bmod a \cdot N$, if $e_{ini} = 0$ then $e_{ini} = a \cdot N$.

$e_{plus} = a \cdot N$

$e_{minus} = a \cdot |\Delta N|$

puncturing for $DN<0$, repeating otherwise.

4.2.7.2 Bit separation and bit collection for rate matching

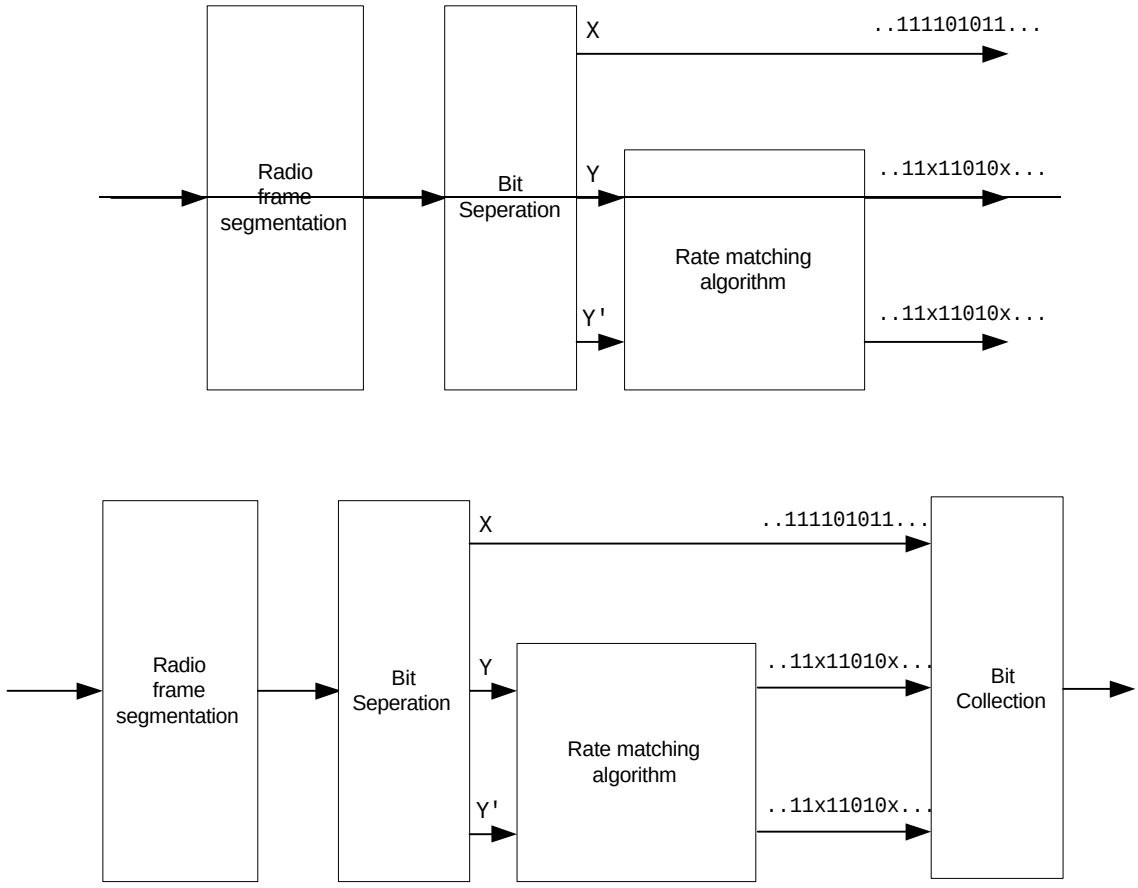

Figure 4-5: Overall rate matching block diagram after first interleaving where x denotes punctured bit

Rate matching puncturing for Turbo codes is applied separately to *Y* and *Y'*sequences. No puncturing is applied to *X* sequence. Therefore, it is necessary to separate *X*, *Y*, and *Y'*sequences before rate matching is applied.

There are two different alternation patterns in bit stream from Radio frame segmentation according to the TTI of a TrCH as shown in table 4.2.7-1.

Table 4.2.7-1: Alternation patterns of bits from radio frame segmentation

TTI (msec)	Alternation patterns
10, 40	… *X,Y,Y'*,…
20, 80	… *X,Y',Y*,…

In addition, each radio frame of a TrCH starts with different initial parity type. Table 4.2.7-2 shows the initial parity type of each radio frame of a TrCH with TTI = {10, 20, 40, 80} msec.

Table 4.2.7-2: Initial parity type of radio frames of TrCH

TTI (msec)	Radio frame indexes (n_i)							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10	*X*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
20	*X*	*Y*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
40	*X*	*Y'*	*Y*	*X*	*NA*	*NA*	*NA*	*NA*
80	*X*	*Y*	*Y'*	*X*	*Y*	*Y'*	*X*	*Y*

Tables 4.2.7-1 and 4.2.7-2 defines a complete output bit pattern from Radio frame segmentation.

Ex. 1. TTI = 40 msec, n_i = 2
Radio frame pattern: *Y, Y,' X, Y, Y,' X, Y, Y,' X,* …

Ex. 2 TTI = 40 msec, n_i = 3
Radio frame pattern: *X, Y, Y,' X, Y, Y,' X, Y, Y,' X,* …

Therefore, bit separation is achieved with the alternative selection of bits with the initial parity type and alternation pattern specified in tables 4.2.7-1 and 4.2.7-2 according to the TTI and n_i of a TrCH.

After rate matching puncturing for Turbo codes, the separated sequences X, Y, and Y' are collected and delivered. The only not punctured bits in each radio frame of TrCH shall be delivered sequentially according to the order in Table 4.2.7-1 and Table 4.2.7-2 for each TTI of a TrCH.

Ex. 1. TTI=40msec, n_i = 2

If radio frame pattern: *Y, ¥,' X, Y, Y,' X, ¥, Y,' X, ..where ¥'and ¥ mean punctured bits.*

Then delivered bits: *Y, X, Y, Y,' X, Y,' X, ..*.

4.2.7.3 Rate matching pattern determination

The bits input to the rate matching are denoted by $e_{i1}, e_{i2}, e_{13}, \ldots, e_{iN_i}$, where *i* is the TrCH with $N = N_{ij} = N_i$. Here N is the parameter given in section 4.2.7.1.The bits output from the rate matching are denoted by $f_{i1}, f_{i2}, f_{13}, \ldots, f_{iV_i}$, where *i* is the TrCH number and $V_i = N + DN$.

Note that the transport format combination number j for simplicity has been left out in the bit numbering.

The rate matching rule is as follows:

if puncturing is to be performed

e = e_{ini} -- initial error between current and desired puncturing ratio

m = 1 -- index of current bit

do while m <= N

e = e – e_{minus} -- update error

if e <= 0 then -- check if bit number m should be punctured

puncture bit $e_{i,m}$

e = e + e_{plus} -- update error

end if

```
        m = m + 1                   --  next bit
    end do
else
    e = e_ini       -- initial error between current and desired puncturing ratio
    m = 1           -- index of current bit
    do while m <= N
        e = e – e_minus             -- update error
        do while e <= 0             -- check if bit number m should be repeated
            repeat bit e_i,m
            e = e + e_plus          -- update error
        end do
        m = m + 1                   --  next bit
    end do
end if
```

A repeated bit is placed directly after the original one.