TSG-RAN Working Group 1(Radio) meeting #9 ***TSGR1#9(99) j11***

30 November – 3 December 1999, Dresden, Germany

Source : LGIC

Title : Revised CR to 25.212 for initial offset value change for convolutional code rate matching

Document for : Approval

1 Introduction

In WG1 #8 in New York, the proposal of changing the current initial offset value of rate matching algorithm for convolutional code[Tdoc R1-99g85] was approved in the plenary. But it was pointed out that the format of CR was wrong and was requested to be revised according to the CR rule with CR number.

The purpose of this document is to provide the revised CR of original Tdoc R1-99g85.

2 Text Proposal

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

Document ??99???
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.

25.212	**CR**	**004**	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:	TSG-RAN #6	for approval	X	strategic		(for SMG
list expected approval meeting # here ↑		for information		non-strategic		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: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: LGIC **Date:** 1999-11-22

Subject: Changing the initial offset value for convolutional code rate matching

Work item:

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

Reason for change: Current initial offset value for convolutional code rate matching provides a poor performance.

Clauses affected: 4.2.7.1.2 Determination of parameters needed for calculating the rate matching pattern
4.2.7.2.1 Determination of rate matching parameters for fixed positions of TrCHs
4.2.7.2.2 Determination of rate matching parameters for flexible positions of TrCHs

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.

4.2.7.1.2 Determination of parameters needed for calculating the rate matching pattern

The number of bits to be repeated or punctured, DN_{ij}, within one radio frame for each TrCH *i* is calculated with equation 1 for all possible transport format combinations *j* and selected every radio frame. $N_{data,j}$ is given from section 4.2.7.1.1. In compressed mode $N_{data,j}$ is replaced by $N_{data,j}^{cm}$ in Equation 1. $N_{data,j}^{cm}$ is given from the following relation:

$N_{data,j}^{cm} = 2N_{data,j} - N_{TGL}$, where

$$N_{TGL} = \begin{cases} \frac{TGL}{15} 2N_{data,j}, \text{ if } N_{first} + TGL \le 15 \\ \frac{15 - N_{first}}{15} 2N_{data,j}, \text{ in first frame if } N_{first} + TGL > 15 \\ \frac{TGL - (15 - N_{first})}{15} 2N_{data,j}, \text{ in second frame if } N_{first} + TGL > 15 \end{cases}$$

N_{first} and TGL are defined in section 4.4.

If DN_{ij} = 0 then the output data of the rate matching is the same as the input data and the rate matching algorithm of section 4.2.7.4 does not need to be executed.

Otherwise, for determining e_{ini}, e_{plus}, e_{minus}, and N the following parameters are needed (regardless if the radio frame is compressed or not):

For convolutional codes,

$q = \lfloor N_{ij} / (|\Delta N_{ij}|) \rfloor$

if q is even

then $q' = q - \gcd(q, F_i)/F_i$ -- where gcd (q, F_i) means greatest common divisor of q and F_i

-- note that q' is not an integer, but a multiple of 1/8

else

q' = q

endif

for x = 0 to F_i-1

$S(I_F(\lceil x*q' \rceil \bmod F_i)) = (\lceil x*q' \rceil \text{ div } F_i)$

end for

$\Delta N = \Delta N_{i,j}$

a = 2

For each radio frame, the rate-matching pattern is calculated with the algorithm in section 4.2.7.4, where :

$N = N_{i,j}$., and

$e_{ini} = (a \cdot S(n_i) \cdot |\Delta N| + 1) \bmod a \cdot N$.

$e_{plus} = a \cdot N$

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

puncturing for DN<0, repeating otherwise.

For turbo codes, if repetition is to be performed, such as $DN_{i,j}$ >0, parameters for turbo codes are the same as parameter for convolutional codes.

If puncturing is to be performed, parameters are as follows.

a=2 for *Y* sequence, and

a=1 for *Y'* sequence.

$$DN = \begin{cases} \lfloor DN_{i,j}/2 \rfloor \text{for Y sequence} \\ \lceil DN_{i,j}/2 \rceil \text{for Y' sequence} \end{cases}$$

$N = \lfloor N_{i,j}/3 \rfloor$,

$q = \lfloor N/|\Delta N| \rfloor$

if($q \leq 2$)

for x=0 to F_i-1

if(Y sequence)

$S[I_F[(3x+1) \bmod F_i]] = x \bmod 2$;

if(Y' sequence)

$S[I_F [(3x+2) \bmod F_i]] = x \bmod 2$;

end for

else

if q is even

then $q' = q - gcd(q, F_i)/ F_i$ -- where $gcd (q, F_i)$ means greatest common divisor of q and F_i
-- note that q' is not an integer, but a multiple of 1/8

else q' = q

endif

for x=0 to F_i -1

$r = \lceil x*q' \rceil \bmod F_i$;

if(Y sequence)

$S[I_F[(3r+1) \bmod F_i]] = \lceil x*q' \rceil \text{ div } F_i$;

if(Y' sequence)

$S[I_F[(3r+2) \bmod F_i]] = \lceil x*q' \rceil \text{ div } F_i$;

endfor

endif

For each radio frame, the rate-matching pattern is calculated with the algorithm in section 4.2.7.4, where:

N is as above,

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

$e_{plus} = a \cdot N$

$e_{minus} = a \cdot |DN|$

puncturing for DN<0, repeating otherwise.

4.2.7.2 Determination of rate matching parameters in downlink

For downlink $N_{data,j}$ does not depend on the transport format combination j. $N_{data,*}$ is given by the channelization code(s) assigned by higher layers.

4.2.7.2.1 Determination of rate matching parameters for fixed positions of TrCHs

First an intermediate calculation variable $N_{i,*}$ is calculated for all transport channels *i* by the following formula:

$$N_{i,*} = \frac{1}{F_i} \cdot \max_{l \in TFS(i)} N_{i,l}^{TTI}$$

The computation of the $\Delta N_{i,l}^{TTI}$ parameters is then performed in for all TrCH *i* and all TF *l* by the following formula, where $\Delta N_{i,*}$ is derived from $N_{i,*}$ by the formula given at section 4.2.7:

$$\Delta N_{i,*}^{TTI} = F_i \cdot \Delta N_{i,*}$$

If $\Delta N_{i,*}^{TTI} = 0$ then, for TrCH *i*, the output data of the rate matching is the same as the input data and the rate matching algorithm of section 4.2.7.4 does not need to be executed.

Otherwise, for determining e_{ini}, e_{plus}, e_{minus}, and N the following parameters are needed:

For convolutional codes,

$$\Delta N = \Delta N_{i,*}^{TTI}$$

a=2

$$N_{max} = \max_{l \in TFS(i)} N_{il}^{TTI}$$

For each transmission time interval of TrCH *i* with TF *l*, the rate-matching pattern is calculated with the algorithm in section 4.2.7.4. The following parameters are used as input:

$$N = N_{il}^{TTI}$$

$$e_{ini} = 1 \, e_{plus} = a \cdot N_{max}$$

$$e_{\min us} = a \cdot |\Delta N|$$

Puncturing if $\Delta N < 0$, repetition otherwise.

For turbo codes, if repetition is to be performed, such as $\Delta N_{i,*}^{TTI} > 0$, parameters for turbo codes are the same as parameter for convolutional codes. If puncturing is to be performed, parameters are as follows.

a=2 for *Y* sequence,

a=1 for *Y'* sequence.

The X bits shall not be punctured.

$$\Delta \mathrm{N} = \begin{cases} \lceil DN_{i,*}^{TTI} / 2 \rceil \text{for Y sequence} \\ \lfloor DN_{i,*}^{TTI} / 2 \rfloor \text{for Y' sequence} \end{cases}$$

$$N_{max} = \max_{l \in TFS(i)} \lfloor N_{il}^{TTI} / 3 \rfloor$$

For each transmission time interval of TrCH *i* with TF *l*, the rate-matching pattern is calculated with the algorithm in section 4.2.7.4. The following parameters are used as input:

$$N = \lfloor N_{il}^{TTI} / 3 \rfloor$$

$$e_{ini} = N_{max}$$

$$e_{plus} = a \cdot N_{max}$$

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

Puncturing if $\Delta N < 0$, repetition otherwise.

4.2.7.2.2 Determination of rate matching parameters for flexible positions of TrCHs

First an intermediate calculation variable N_{ij} is calculated for all transport channels *i* and all transport format combinations *j* by the following formula:

$$N_{i,j} = \frac{1}{F_i} \cdot N_{i,TF_i(j)}^{TTI}$$

Then rate matching ratios RF_i are calculated for each the transport channel *i* in order to minimise the number of DTX bits when the bit rate of the CCTrCH is maximum. The RF_i ratios are defined by the following formula:

$$RF_i = \frac{N_{data,*}}{\max\limits_{j \in TFCS} \sum\limits_{i=1}^{i=I} \left(RM_i \cdot N_{i,j}\right)} \cdot RM_i$$

The computation of $\Delta N_{i,l}^{TTI}$ parameters is then performed in two phases. In a first phase, tentative temporary values of $\Delta N_{i,l}^{TTI}$ are computed, and in the second phase they are checked and corrected. The first phase, by use of the RF_i ratios, ensures that the number of DTX indication bits inserted is minimum when the CCTrCH bit rate is maximum, but it does not ensure that the maximum CCTrCH bit rate is not greater than $N_{data,*}$. per 10ms. The latter condition is ensured through the checking and possible corrections carried out in the second phase.

At the end of the second phase, the latest value of $\Delta N_{i,l}^{TTI}$ is the definitive value.

The first phase defines the tentative temporary $\Delta N_{i,l}^{TTI}$ for all transport channel *i* and any of its transport format *l* by use of the following formula:

$$\Delta N_{i,l}^{TTI} = F_i \cdot \left\lceil \frac{RF_i \cdot N_{i,l}^{TTI}}{F_i} \right\rceil - N_{i,l}^{TTI}$$

The second phase is defined by the following algorithm:

for all j in *TFCS* do -- for all TFC

$$D = \sum_{i=1}^{i=I} \frac{N_{i,TF_i(j)}^{TTI} + \Delta N_{i,TF_i(j)}^{TTI}}{F_i}$$ -- CCTrCH bit rate (bits per 10ms) for TFC *l*

if $D > N_{data,*}$ then

for *i* = 1 to *I* do -- for all TrCH

$\Delta N = F_i \cdot \Delta N_{i,j}$ -- $\Delta N_{i,j}$ is derived from $N_{i,j}$ by the formula given at section 4.2.7.

if $\Delta N_{i,TF_i(j)}^{TTI} > \Delta N$ then

$$\Delta N_{i,TF_i(j)}^{TTI} = \Delta N$$

end-if

end-for

end-if

end-for

NOTE: The order in which the transport format combinations are checked does not change the final result.

If $\Delta N_{i,l}^{TTI} = 0$ then, for TrCH *i* at TF *l*, the output data of the rate matching is the same as the input data and the rate matching algorithm of section 4.2.7.4 does not need to be executed.

Otherwise, for determining e_{ini}, e_{plus}, e_{minus}, and N the following parameters are needed:

For convolutional codes,

$$\Delta N = \Delta N_{il}^{TTI}$$

$a=2$

For each transmission time interval of TrCH *i* with TF *l*, the rate-matching pattern is calculated with the algorithm in section 4.2.7.4. The following parameters are used as input:

$$N = N_{il}^{TTI}$$

$$e_{ini} = 1$$

$$e_{plus} = a \cdot N$$

$$e_{\min us} = a \cdot |\Delta N|$$

puncturing for $\Delta N < 0$, repeating otherwise.

For turbo codes, if repetition is to be performed, such as $\Delta N_{il}^{TTI} > 0$, parameters for turbo codes are the same as parameter for convolutional codes. If puncturing is to be performed, parameters are as follows.

$a=2$ for Y sequence,

$a=1$ for Y' sequence.

X bits shall not be punctured.

$$\Delta \mathrm{N} = \begin{cases} \lfloor DN_{il}^{TTI} / 2 \rfloor & \text{for Y sequence} \\ \lceil DN_{il}^{TTI} / 2 \rceil & \text{for Y' sequence} \end{cases}$$

For each transmission time interval of TrCH *i* with TF *l*, the rate-matching pattern is calculated with the algorithm in section 4.2.7.4. The following parameters are used as input:

N = $\lfloor N_{il}^{TTI} / 3 \rfloor$,

e_{ini} = N ,

$$e_{plus} = a \cdot N$$

$$e_{\min us} = a \cdot |\Delta N|$$

puncturing for $\Delta N < 0$, repeating otherwise.