TSG-RAN Working Group1 meeting #11
San Diego, USA, February 29 – March 3, 2000

TSGR1#11(00)0292

Agenda item:

Source: **NTT DoCoMo and NEC**

Title: **Addition of padding function for smaller Turbo coding block**

Document for: **Decision**

Introduction

This document includes CRs on addition of padding function for Turbo coding block with smaller sizes of less than 40-bit and this addition was agreed in R1 #10 meeting [1], followed by the agreement on the extension of Turbo code internal interleaver[2]. The proposed padding function is put in the bit filler function of the current code block segmentation and is commonly added to both TS25.212 and TS25.222.

References

[1] Ad hoc 5, "Ad hoc 5 meeting report on 1-20-00", TSGR1#10(00)0155
[2] NTT DoCoMo and Nortel Networks, "Modification of Turbo code internal interleaver", TSGR1#10(00)0160

3GPP RAN WG1 Meeting #11
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or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.212	CR	057	Current Version:	3.1.1

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

For submission to:	RAN #7	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 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: NTT DoCoMo and NEC **Date:** 25-Feb-2000

Subject: Addition of padding function for smaller Turbo coding block

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: Addition of padding function for smaller Turbo coding block size of less than 40-bit and editorial changes

Clauses affected: 4.2.2.2 of TS25.212

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:

4.2.2.1 Concatenation of transport blocks

The bits input to the transport block concatenation are denoted by $b_{im1}, b_{im2}, b_{im3}, \ldots, b_{imB_i}$ where i is the TrCH number, m is the transport block number, and B_i is the number of bits in each block (including CRC). The number of transport blocks on TrCH i is denoted by M_i. The bits after concatenation are denoted by $x_{i1}, x_{i2}, x_{i3}, \ldots, x_{iX_i}$, where i is the TrCH number and $X_i = M_i B_i$. They are defined by the following relations:

$x_{ik} = b_{i1k}$ $k = 1, 2, \ldots, B_i$

$x_{ik} = b_{i,2,(k-B_i)}$ $k = B_i + 1, B_i + 2, \ldots, 2B_i$

$x_{ik} = b_{i,3,(k-2B_i)}$ $k = 2B_i + 1, 2B_i + 2, \ldots, 3B_i$

…

$x_{ik} = b_{i,M_i,(k-(M_i-1)B_i)}$ $k = (M_i - 1)B_i + 1, (M_i - 1)B_i + 2, \ldots, M_i B_i$

4.2.2.2 Code block segmentation

Segmentation of the bit sequence from transport block concatenation is performed if $X_i > Z$. The code blocks after segmentation are of the same size. The number of code blocks on TrCH i is denoted by C_i. If the number of bits input to the segmentation, X_i, is not a multiple of C_i, filler bits are added to the last block. The filler bits are transmitted and they are always set to 0. The maximum code block sizes are:

convolutional coding: $Z = 504$

turbo coding: $Z = 5114$

no channel coding: $Z =$ *unlimited*

The bits output from code block segmentation 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.

Number of code blocks: $C_i = \acute{e}X_i / Z\grave{u}$

Number of bits in each code block:

if $X_i < 40$ and Turbo coding is used, then
$K_i = 40$
else
$K_i = \acute{e}X_i / C_i\grave{u}$
end if

Number of filler bits: $Y_i = C_i K_i - X_i$

~~I~~if $X_i \le Z$, then

$o_{i1k} = x_{ik}$ ~~,~~ $k = 1, 2, \ldots, K_i - Y_i$

$o_{i1k} = 0$ $k = (K_i - Y_i) + 1, (K_i - Y_i) + 2, \ldots, K_i$

end if

~~and $K_i = X_i$.~~

~~I~~if X_i ~~≥~~ > Z, then

$o_{i1k} = x_{ik}$ $k = 1, 2, \ldots, K_i$

$o_{i2k} = x_{i,(k+K_i)}$ $k = 1, 2, \ldots, K_i$

$o_{i3k} = x_{i,(k+2K_i)}$ $k = 1, 2, \ldots, K_i$

…

$o_{iC_ik} = x_{i(k+(C_i-1)K_i)}$ $k = 1, 2, \ldots, K_i - Y_i$

$o_{iC_ik} = 0$ $k = (K_i - Y_i) + 1, (K_i - Y_i) + 2, \ldots,$ ~~K_i~~ K_i

end if

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CHANGE REQUEST

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25.222	CR	028	Current Version:	3.1.1

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

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

Source: NTT DoCoMo and NEC **Date:** 25-Feb-2000

Subject: Addition of padding function for smaller Turbo coding block

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Reason for change: Addition of padding function for smaller Turbo coding block size of less than 40-bit and editorial changes

Clauses affected: 4.2.2.2 of TS25.222

Other specs affected:

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

Other comments:

4.2.2 Transport block concatenation and code block segmentation

All transport blocks in a TTI are serially concatenated. If the number of bits in a TTI is larger than the maximum size of a code block , then code block segmentation is performed after the concatenation of the transport blocks. The maximum size of the code blocks depends on whether convolutional, turbo coding or no coding is used for the TrCH.

4.2.2.1 Concatenation of transport blocks

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4.2.2.2 Code block segmentation

~~NOTE: It is assumed that filler bits are set to 0.~~

Segmentation of the bit sequence from transport block concatenation is performed if $X_i > Z$. The code blocks after segmentation are of the same size. The number of code blocks on TrCH i is denoted by C_i. If the number of bits input to the segmentation, X_i, is not a multiple of C_i, filler bits are added to the last block. The filler bits are transmitted and they are always set to 0. The maximum code block sizes are:

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$o_{i1k} = 0$ $k = (K_i - Y_i) + 1, (K_i - Y_i) + 2, \ldots, K_i$

end if

~~and $K_i = X_i$.~~

~~I~~if X_i ~~>~~ $\geq Z$, then

$$o_{i1k} = x_{ik} \quad k = 1, 2, \ldots, K_i$$

$$o_{i2k} = x_{i,(k+K_i)} \quad k = 1, 2, \ldots, K_i$$

$$o_{i3k} = x_{i,(k+2K_i)} \quad k = 1, 2, \ldots, K_i$$

…

$$o_{iC_ik} = x_{i(k+(C_i-1)K_i)} \quad k = 1, 2, \ldots, K_i - Y_i$$

$$o_{iC_ik} = 0 \quad k = (K_i - Y_i) + 1, (K_i - Y_i) + 2, \ldots, K_i$$

end if