TSG RAN Working Group 1 meeting #16

Pusan, Korea
October 10 – 13, 2000

TSGR1#16(00)1277

Agenda item: AH99

Source: Mitsubishi Electric (Trium R&D)

Title: CR 25.212 and 25.222, clarification on code block number (C_i) formula

Document for: Decision

Introduction

Currently the value of the $C_i = \left\lceil \frac{X_i}{Z} \right\rceil$ for $Z = unlimited$ is not clearly defined. Our understanding is that it is equal to the limit of the function $Z \to \left\lceil \frac{X_i}{Z} \right\rceil$ when $Z \to \infty$, that is to say to 1 for $X_i > 0$ and to 0 otherwise.

This is clarified in this CR.

Furthermore, when $C_i = 0$, the computation of the code block size (K_i) is not applicable.

Note that $C_i = 0$ for the following cases :

- $M_i = 0$ (no transport blocks), or
- $A_i = 0$ (null size transport block), and CRC size = 0, even if $M_i > 0$

Note also that for turbo coding, the padding up to 40 bits was originally intended to improve the coding quality when the number of bits to encode is less than 40, but this improvement is useless for zero coding bits. So taking $C_i = 0$ in that case does not make things worse.

Note that in 25.222 there was also an erroneous index, so the CR on 25.222 is marked as correction and not as editorial.

3GPP TSG RAN WG1#16
Pusan, Korea

Document R1-00-1277
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**	**97**	Current Version:	3.4.0

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

For submission to:	RAN#10	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: Mitsubishi Electric (Trium R&D) **Date:** 2000-10

Subject: Clarification on the C_i formula

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			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification	X		Release 99	X
				Release 00	

Reason for change:

?? The value of $\lfloor X_i / Z \rfloor$ for $Z = unlimited$ is not so obvious, all the more that $x - \lfloor x \rfloor$ is not a continuous function.

?? The code block size computation is not applicable when the number of code block is null

Clauses affected: 4.2.2.2

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: This also clarify that the padding up to 40 bits for turbo coding is not applicable for $C_i = 0$.

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 beginning of the first block. If turbo coding is selected and $X_i < 40$, filler bits are added to the beginning of the code 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, for $C_i \neq 0$, 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 per code block.

Number of code blocks:

~~$C_i = \lceil X_i / Z \rceil$~~

$$C_i = \begin{cases} \lceil X_i / Z \rceil & \text{when } Z \neq unlimited \\ 0 & \text{when } Z = unlimited \text{ and } X_i = 0 \\ 1 & \text{when } Z = unlimited \text{ and } X_i \neq 0 \end{cases}$$

Number of bits in each code block (applicable for $C_i \neq 0$ only):

if $X_i < 40$ and Turbo coding is used, then

$K_i = 40$

else

$K_i = \lceil X_i / C_i \rceil$

end if

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

for $k = 1$ to Y_i -- Insertion of filler bits

$o_{i1k} = 0$

end for

for $k = Y_i + 1$ to K_i

$o_{i1k} = x_{i,(k-Y_i)}$

end for

$r = 2$ -- Segmentation

while $r \leq C_i$

for $k = 1$ to K_i

$o_{irk} = x_{i,(k+(r-1)K_i-Y_i)}$

end for

$r = r + 1$

end while

end if

3GPP TSG RAN WG1#16
Pusan, Korea

Document R1-00-1277
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**	**49**	Current Version:	3.4.0

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

For submission to:	RAN#10	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: Mitsubishi Electric (Trium R&D) **Date:** 2000-10

Subject: Clarification on the C_i formula

Work item:

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 value of $\lfloor X_i / Z \rfloor$ for Z = *unlimited* is not so obvious, all the more that $x \mapsto \lfloor x \rfloor$ is not a continuous function.
?? The code block size computation is not applicable when the number of code block is null
?? Y_I was replaced by Y_i somewhere in the section.

Clauses affected: 4.2.2.2

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: This also clarify that the padding up to 40 bits for turbo coding is not applicable for C_i = 0.

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 beginning of the first block. If turbo coding is selected and $X_i < 40$, filler bits are added to the beginning of the code 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, for $C_i \neq 0$, 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 per code block.

Number of code blocks:

~~$C_i = \lceil X_i / Z \rceil$~~

$$C_i = \begin{cases} \lceil X_i / Z \rceil & \text{when } Z \neq unlimited \\ 0 & \text{when } Z = unlimited \text{ and } X_i = 0 \\ 1 & \text{when } Z = unlimited \text{ and } X_i \neq 0 \end{cases}$$

Number of bits in each code block (applicable for $C_i \neq 0$ only):

if $X_i < 40$ and Turbo coding is used, then

$K_i = 40$

else

$K_i = \lceil X_i / C_i \rceil$

end if

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

for $k = 1$ to ~~Y_i~~ Y_i -- Insertion of filler bits

$o_{i1k} = 0$

end for

for $k = Y_i + 1$ to K_i

$o_{i1k} = x_{i,(k-Y_i)}$

end for

$r = 2$ -- Segmentation

while $r \leq C_i$

for $k = 1$ to K_i

$o_{irk} = x_{i,((r-1)K_i - Y_i)}$

end for

r = r+1

end while