TSG-RAN Working Group 1 meeting #11
San Diego, USA
February 29 – March 3, 2000

TSGR1#11(00)0364

Agenda item:

Source: Ericsson

Title: Removal of DL compressed mode by higher layer scheduling with fixed positions

Document for: Decision

---

1 Introduction

Compressed mode by higher layer scheduling obtains a transmission gap (TG) by setting restrictions on the transport format combination set (TFCS). Higher layers will schedule one or several TrCHs in the CCTrCH so that they can guarantee that some TFCs are not needed in a certain TTI. By doing this it is possible to obtain a TG on the physical layer.

The implementation of compressed mode by higher layer scheduling is slightly different for the following three cases:

- Uplink
- Downlink with flexible positions of the TrCHs in the radio frame
- Downlink with fixed positions of the TrCHs in the radio frame.

In the uplink, the number of bits available to the CCTrCH on the PhCH(s) is decreased by the number of bits corresponding to the TG. This is similar to the downlink when flexible starting positions of the TrCHs are used. In that case, DTX is inserted in one point for all TrCHs in the CCTrCH. In compressed mode by higher layer scheduling, the number of DTX bits to insert is decreased with the number corresponding to the TG.

When fixed positions are used in the downlink, it must be made sure that the positions of the TrCHs are predefined also in compressed mode. Consider the example in Figure 1.

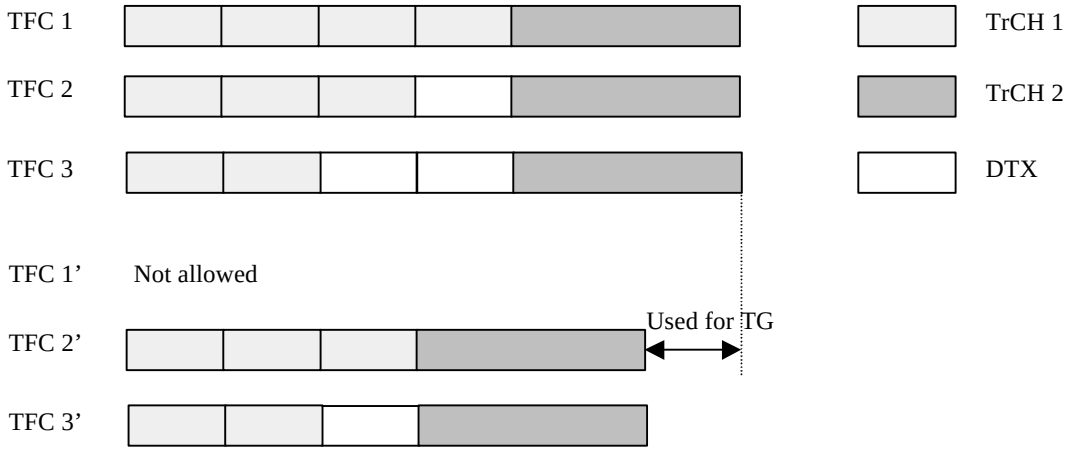

Figure 1: One variable rate TrCH and one fix rate TrCH.

In the example, a TG can be obtained both with TFC 2 and TFC 3. TrCH 2 should still always start at the same position in compressed mode and DTX is therefore inserted in the 1st DTX insertion point of the multiplexing chain for TFC 3.

Now consider the example in figure 2.

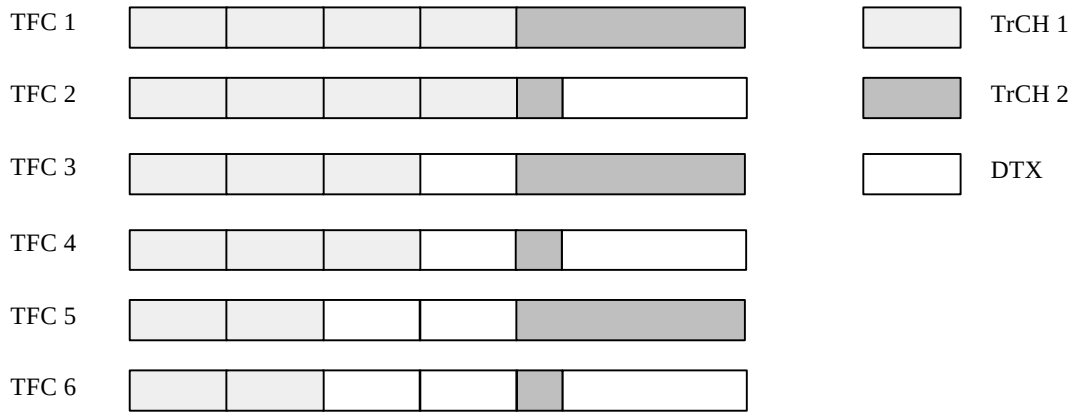

Figure 2: Two variable rate TrCHs.

Higher layers still only put restrictions on TrCH 1. TrCH2 may for example be a real time TrCH that can not be scheduled. Hence, in compressed mode only TFC 3-6 are allowed. It is currently assumed in 25.212 that this is signalled from higher layers. Note that this signalling is not needed in the uplink, nor in the downlink with flexible starting positions of the TrCHs. I.e. for all other cases it is enough to signal the length of the TG. With fixed starting points of the TrCHs it is not possible to derive what TFCs that are allowed form the TGL alone. From only looking at the TGL in the example above, it is not possible to conclude that TFC 2 is not allowed.

The number of bits needed for signalling what TFCs that are allowed (or the ones that are not allowed) is significant since there could be up to 64 TFCs if blind transport format detection is used. If fixed starting positions are used with TFCI, the number of TFCs could be even larger.

Fixed starting positions of the TrCHs are needed when blind transport format detection (BTFD) is used. BTFD is only intended for low bit rate services and higher layer scheduling is only possible if UTRAN is allowed to schedule or control the bitstream(s) on the TrCH(s). Low bitrate TrCHs under the control of UTRAN are not expected to be so common that they justify special and extensive signalling. Hence, it is proposed that higher layer scheduling only should be allowed with flexible starting positions of the TrCHs in the radio frame.

The enclosed CR also propose that it is clarified that the DTX insertion with higher layer scheduling with flexible starting position of the TrCHs only is limited for the radio frames that contain the TGs or part of the TGs. Further it is clarified that in the downlink, the TFCI field is expanded on the expense of the data fields and this shall be taken into account by higher layers when setting the restrictions on the TFCs.

3GPP TSG RAN WG1 Meeting #11
San Diego, USA, February 29 – March 3, 2000

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	061	Current Version:	3.1.0

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

For submission to:	TSG-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: Ericsson **Date:** 2000-02-29

Subject: Removal of DL compressed mode by higher layer scheduling with fixed positions

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	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: WG2 has not specified the special signalling needed for compressed mode by higher layer scheduling with fixed starting positions and since the benefit of this feature is viewed as limited it is proposed that it is removed.

Clauses affected: 4.2.9 and 4.4.3

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.

4.2.9 Insertion of discontinuous transmission (DTX) indication bits

In the downlink, DTX is used to fill up the radio frame with bits. The insertion point of DTX indication bits depends on whether fixed or flexible positions of the TrCHs in the radio frame are used. It is up to the UTRAN to decide for each CCTrCH whether fixed or flexible positions are used during the connection. DTX indication bits only indicate when the transmission should be turned off, they are not transmitted.

4.2.9.1 1st insertion of DTX indication bits

This step of inserting DTX indication bits is used only if the positions of the TrCHs in the radio frame are fixed. With fixed position scheme a fixed number of bits is reserved for each TrCH in the radio frame.

The bits from rate matching are denoted by $g_{i1}, g_{i2}, g_{i3}, \ldots, g_{iG_i}$, where G_i is the number of bits in one TTI of TrCH i. Denote the number of bits in one radio frame of TrCH i by H_i. In normal or compressed mode by spreading factor reduction, H_i is constant and corresponds to the maximum number of bits from TrCH i in one radio frame for any transport format of TrCH i. ~~In compressed mode by higher layer scheduling, only a subset of the TFC Set is allowed. From this subset it is possible to derive which TFs on each TrCH that are allowed. The maximum number of bits belonging to one TTI of TrCH i for the allowed TFs is denoted by X_i. H_i is then calculated as $H_i = \left\lceil \frac{X_i}{F_i} \right\rceil$, where F_i is the number of radio frames in a TTI of TrCH i.~~ The bits output from the DTX insertion are denoted by $h_{i1}, h_{i2}, h_{i3}, \ldots, h_{i(F_i H_i)}$. Note that these bits are three valued. They are defined by the following relations:

$h_{ik} = g_{ik}$ k = 1, 2, 3, …, G_i

$h_{ik} = d$ $k = G_i+1, G_i+2, G_i+3, \ldots, F_i H_i$

where DTX indication bits are denoted by d. Here $g_{ik} \in \{0, 1\}$ and $d \notin \{0, 1\}$.

4.2.9.2 2nd insertion of DTX indication bits

The DTX indication bits inserted in this step shall be placed at the end of the radio frame. Note that the DTX will be distributed over all slots after 2nd interleaving.

The bits input to the DTX insertion block are denoted by $s_1, s_2, s_3, \ldots, s_S$, where S is the number of bits from TrCH multiplexing. The number of PhCHs is denoted by P and the number of bits in one radio frame, including DTX indication bits, for each PhCH by U. The number of available bits on the PhCH is denoted by N_{data} and $N_{data}=15N_{data1}+15N_{data2}$, where N_{data1} and N_{data2} are defined in [25.211]. In normal mode $U=N_{data}$. In compressed mode N_{data} is changed from the value in normal node for the radio frames containing the TGs or part of the TGs.. The exact value of N_{data} is dependent on the TGL and the transmission time reduction method, which are signalled from higher layers. The number of bits that are located within the transmission gap is denoted N_{TGL} and defined as:

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

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

In the radio frames that contain the TGs or part of the TGs~~compressed mode~~ $U=N_{data}-N_{TGL}$..

The bits output from the DTX insertion block are denoted by $w_1, w_2, w_3, \ldots, w_{(PU)}$. Note that these bits are threevalued. They are defined by the following relations:

$w_k = s_k$ k = 1, 2, 3, …, S

$w_k = d$ k = S+1, S+2, S+3, …, PU

where DTX indication bits are denoted by *d*. Here $s_k \in \{0,1\}$ and $d \notin \{0,1\}$.

4.4.3 Transmission time reduction method

When in compressed mode, the information normally transmitted during a 10 ms frame is compressed in time. The mechanisms provided for achieving this are puncturing, reduction of the spreading factor by a factor of two , and higher layer scheduling. In the downlink, all methods are supported while compressed mode by puncturing is not used in the uplink. The maximum idle length is defined to be 7 slots per one 10 ms frame. The slot formats that are used in compressed mode are listed in [2].

4.4.3.1 Compressed mode by puncturing

During compressed mode, rate matching (puncturing) is applied for creating transmission gap in one frame. The algorithm for rate matching (puncturing) as described in section 4.2.7 is used.

4.4.3.2 Compressed mode by reducing the spreading factor by 2

During compressed mode, the spreading factor (SF) can be reduced by 2 during one radio frame to enable the transmission of the information bits in the remaining time slots of a compressed frame.

On the downlink, UTRAN can also order the UE to use a different scrambling code in compressed mode than in normal mode. If the UE is ordered to use a different scrambling code in compressed mode, then there is a one-to-one mapping between the scrambling code used in normal mode and the one used in compressed mode, as described in TS 25.213[3] section 5.2.1.

4.4.3.3 Compressed mode by higher layer scheduling

Compressed mode can be obtained by higher layer scheduling. Higher layers then set restrictions so that only a subset of the allowed TFCs are used in compressed mode. The maximum number of bits that will be delivered to the physical layer during the compressed radio frame is then known and a transmission gap can be generated. Note that in the downlink, the TFCI field is expanded on the expense of the data fields and this shall be taken into account by higher layers when setting the restrictions on the TFCs. Compressed mode by higher layer scheduling shall not be used with fixed starting positions of the TrCHs in the radio frame.