TSG RAN Working Group 1 (Radio layer 1) *TSGR1#15 (00) 1102*
Berlin (Germany), 21st August – 25th August 2000

Agenda Item: 4

Source: Alcatel

Title: CR 25.214-110r3: power setting in compressed and recovery frames for downlink compressed mode

Document for: Decision

Introduction

During the joint 3GPP R1-R3 ad-hoc meeting that took place April 11th, it was agreed that downlink inner-loop power control would be fully specified, including the downlink inner-loop power control in compressed mode. This is now reflected in TS 25.214 [1].

However, in compressed mode, the change of the downlink transmit power during the compressed and recovery frames (due to the increased bit rate) is currently not yet specified.

Therefore, in this contribution, we propose to complete the current description of downlink power control in compressed mode, see attached CR.

The proposed solution is simple and does not require any additional signalling. It consists in having a transmit power change in compressed and recovery frames equal to the target SIR variation in these frames. In downlink, the target SIR variation during compressed and recovery frames is currently specified in TS 25.331 [2]. This SIR variation is the sum of two terms:

- The first term (ΔSIR_compression) enables to compensate for the bit rate increase during compressed frames and is equal to 0 dB in recovery frames,
- The second term (ΔSIR_coding) enables to compensate for the performance degradation due to the power control interruption during the transmission gap or excessive puncturing (in case of compressed mode by puncturing). This term is determined in the UE thanks to signaling from the UTRAN to the UE, see TS 25.331 [2] (parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1 and DeltaSIRafter2).

In the Node B, the first term can be computed the same way as in the UE, but for the second term, the parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1 and DeltaSIRafter2 are not known for the downlink power control, but only for the uplink [3, 4]. However, these parameters mainly depend on the environment and UE speed and therefore will have the same order of magnitude for both links. Therefore, we propose to use the uplink values of these parameters (known in the Node B) in order to derive the downlink transmit power changes during the compressed and recovery frames.

Thus, the proposed solution simply consists in increasing the DPDCH and DPCCH powers in the same proportion as the downlink target SIR (the power offsets PO1, PO2 and PO3 being unchanged).

References

[1] 3GPP TS 25.214 version 3.3.0, “Physical layer procedures”, June 2000

[2] 3GPP TS 25.331 version 3.4.0, “RRC protocol specifications”, June 2000

[3] 3GPP TS 25.433 version 3.2.0, “UTRAN Iub Interface NBAP Signalling”, June 2000

[4] 3GPP R3-00-1975, “CR 25.433-195r1: compressed mode”, Nokia, June 2000

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***Document* R1-00-1102**
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.

25.214 CR 110r3 Current Version: 3.3.0

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

For submission to: TSG-RAN #9
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: (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Alcatel **Date:** 2000-08-14

Subject: Downlink inner-loop power control in compressed mode

Work item: Inner-loop power control

Category:
(only one category Shall be marked With an X)

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: In downlink compressed mode, the change of transmit power during the compressed frames was not specified so far.

Clauses affected: 5.2.1.3

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:

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5.2.1.3 Power control in compressed mode

The aim of downlink power control in uplink or/and downlink compressed mode is to recover as fast as possible a signal-to-interference ratio (SIR) close to the target SIR after each transmission gap.

The UE behaviour is the same in compressed mode as in normal mode, described in subclause 5.2.1.2.

In compressed mode, compressed frames may occur in either the uplink or the downlink or both. In compressed frames, the transmission of downlink DPDCH(s) and DPCCH shall be stopped during transmission gaps.

The power of the DPCCH and DPDCH in the first slot after the transmission gap should be set to the same value as in the slot just before the transmission gap.

~~During RPL slots after each transmission gap, ordinary transmit power control algorithm is applied with a step size~~ ~~Δ_{RP-TPC} instead of Δ_{TPC}, where:~~

- ~~Δ_{RP-TPC} is called the recovery power control step size and is expressed in dB. Δ_{RP-TPC} is equal to the minimum value of 3 dB and $2\Delta_{TPC}$.~~

- ~~RPL is called recovery period length and is equal to the minimum value out of the transmission gap length and 7 slots.~~

~~After the recovery period, ordinary transmit power control resumes with step size Δ_{TPC}.~~

In every slot during compressed mode, after estimating the k:th TPC command, UTRAN shall adjust the current downlink power $P(k\text{-}1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$P(k) = P(k - 1) + P_{TPC}(k) + P_{SIR}(k) + P_{bal}(k)$,

where $P_{TPC}(k)$ is the k:th power adjustment due to the inner loop power control, $P_{SIR}(k)$ is the k-th power adjustment due to the downlink target SIR variation, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in TS 25.433, and an example of how $P_{bal}(k)$ can be calculated is given in Annex B.3.

Due to transmission gaps in uplink compressed frames, there may be missing TPC commands in the uplink. If no uplink TPC command is received, $P_{TPC}(k)$ derived by the Node B shall be set to zero. Otherwise, $P_{TPC}(k)$ is calculated the same way as in normal mode (see sub-clause 5.2.1.2.2) but with a step size Δ_{STEP} instead of Δ_{TPC}. The power control step size $\Delta_{STEP} = \Delta_{RP-TPC}$ during RPL slots after each transmission gap and $\Delta_{STEP} = \Delta_{TPC}$ otherwise, where:

- RPL is the recovery period length and is expressed as a number of slots. RPL is equal to the minimum value out of the transmission gap length and 7 slots. If a transmission gap is scheduled to start before RPL slots have elapsed, then the recovery period shall end at the start of the gap, and the value of RPL shall be reduced accordingly.

- Δ_{RP-TPC} is called the recovery power control step size and is expressed in dB. Δ_{RP-TPC} is equal to the minimum value of 3 dB and $2\Delta_{TPC}$.

The power offset $P_{SIR}(k) = \delta P_{curr} - \delta P_{prev}$, where δP_{curr} and δP_{prev} are respectively the value of δP in the current slot and the most recently transmitted slot and δP is computed as follows:

$$\delta P = \max(\Delta P1\_compression, \ldots, \Delta Pn\_compression) + \Delta P1\_coding + \Delta P2\_coding$$

where n is the number of different TTI lengths amongst TTIs of all TrChs of the CCTrCh, where ΔP1_coding and ΔP2_coding are computed from uplink parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1, DeltaSIRafter2 signaled by higher layers as:

- ΔP1_coding = DeltaSIR1 if the start of the first transmission gap in the transmission gap pattern is within the current frame.

- ΔP1coding = DeltaSIRafter1 if the current frame just follows a frame containing the start of the first transmission gap in the transmission gap pattern.

- ΔP2_coding = DeltaSIR2 if the start of the second transmission gap in the transmission gap pattern is within the current frame.

- ΔP2_coding = DeltaSIRafter2 if the current frame just follows a frame containing the start of the second transmission gap in the transmission gap pattern.
- ΔP1_coding = 0 dB and ΔP2_coding = 0 dB in all other cases.

and ΔPi_compression is defined by :

- ΔPi_compression = 3 dB for downlink frames compressed by reducing the spreading factor by 2.
- ΔPi_compression = 10 log $(15*F_i / (15*F_i - TGL_i))$ if there is a transmission gap created by puncturing method within the current TTI of length F_i frames, where TGL_i is the gap length in number of slots (either from one gap or a sum of gaps) in the current TTI of length F_i frames.
- ΔPi_compression = 0 dB in all other cases.

In case several compressed mode patterns apply to the same frame, a δP offset is computed for each compressed mode pattern and the sum of all δP offsets is applied to the frame.