**3GPP TSG RAN Meeting #20** **RP-030277**
**Hameenlinna, FINLAND, 3 - 6 June 2003**

**Title:** **CR (Rel-5) to TS 25.224**

**Source:** **TSG-RAN WG1**

**Agenda item:** **7.1.5**

### 1. *TS 25.224* (RP-030277)

| RP Tdoc # | WG Toc# | Spec | CR | Rev | Subject | Phase | Cat | Curren | New V | Workitem | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RP-030277 | R1-030417 | 25.224 | 120 | - | Clarifications for the 1.28Mcps TDD power control procedure | Rel-5 | F | 5.4.0 | 5.5.0 | LCRTDD | |

**3GPP TSG-RAN1 Meeting #32**
**Paris, France, 19-23 May 2003**

***Tdoc ⌘R1-030417***

*CR-Form-v7*

# CHANGE REQUEST

| ⌘ | 25.224 | CR | 120 | ⌘ rev | - | ⌘ | Current version: | 5.4.0 | ⌘ |
|---|---|---|---|---|---|---|---|---|---|

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ [-] ME [X] Radio Access Network [X] Core Network [-]

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|---|---|---|---|---|
| ***Title:*** | ⌘ | Clarifications for the 1.28Mcps TDD power control procedure | | |
| ***Source:*** | ⌘ | TSG RAN WG1 | | |
| ***Work item code:*** | ⌘ | LCRTDD | ***Date:*** ⌘ | 19/05/2003 |
| ***Category:*** | ⌘ | F<br>*Use one of the following categories:*<br>***F*** *(correction)*<br>***A*** *(corresponds to a correction in an earlier release)*<br>***B*** *(addition of feature),*<br>***C*** *(functional modification of feature)*<br>***D*** *(editorial modification)*<br>Detailed explanations of the above categories can be found in 3GPP TR 21.900. | ***Release:*** ⌘ | Rel-5<br>*Use one of the following releases:*<br>*2 (GSM Phase 2)*<br>*R96 (Release 1996)*<br>*R97 (Release 1997)*<br>*R98 (Release 1998)*<br>*R99 (Release 1999)*<br>*Rel-4 (Release 4)*<br>*Rel-5 (Release 5)*<br>*Rel-6 (Release 6)* |

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|---|---|---|
| ***Reason for change:*** | ⌘ | The current LCR standard is unclear with respect to the power control procedures; in particular behaviour with respect to the maximum transmission power level, association of TPC symbols and timeslot/CCTrCh pairs, behaviour of the UTRAN on receiving TPC symbols and SIR based TPC calculation |
| ***Summary of change:*** | ⌘ | Clarifications of LCR power control behaviour with respect to maximum transmission level, TPC symbol to CCTrCh/timeslot association and SIR based TPC calculation have been introduced. |
| ***Consequences if not approved:*** | ⌘ | The standard will remain unclear and open to misinterpretation of UE and UTRAN behaviour |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 5.1.1.1, 5.1.1.4, 5.1.1.5, 5.1.2, 5.1.2.4, A2, A3, A4 | | | | |
| | | **Y** | **N** | | | |
| ***Other specs affected:*** | ⌘ | | X | Other core specifications | ⌘ | |
| | | | X | Test specifications | | |
| | | | X | O&M Specifications | | |
| ***Other comments:*** | ⌘ | | | | | |

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Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under [ftp://ftp.3gpp.org/specs/](ftp://ftp.3gpp.org/specs/) For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

## 4.11.2 HS-DSCH Channel Quality Indication Procedure

The channel quality indicator (CQI) provides the NodeB with an estimate of the code rate that would have maximised the single-transmission throughput of the previous HS-DSCH transmission if decoded in isolation. The CQI report requires to be referenced to a given set of HS-PDSCH resources by the NodeB, but note that the UE is not restricted to making measurements only on these reference resources when deriving a given CQI. The reference resources for a CQI report shall be a set of HS-PDSCH resources that were received by the UE in a single TTI, and contain a complete transport block. These resources will be known to the NodeB from the relative timings of the HS-SICH carrying the CQI and previous HS-DSCH transmissions to the UE.

The CQI consists of two fields; a Recommended Transport Block Size (RTBS) and a Recommended Modulation Format (RMF). The UE shall use the same mapping table for these fields as is being used for the time slot information and modulation scheme information fields respectively of the HS-SCCH [18].

The reporting procedure is as follows:

1. The UE receives a message on an HS-SCCH telling it which resources have been allocated to it for the next associated HS-DSCH transmission.

2. The UE reads the associated HS-DSCH transmission, and makes the necessary measurements to derive a CQI that it estimates would have given it the highest single-transmission throughput for the allocated resources whilst achieving a BLER of no more than 10 %.

   BLER, in this context, is defined as the probability that a transport block transmitted using the RTBS and RMF is received in error if decoded in isolation. For the purposes of this calculation, it shall be assumed that the transport block that would be transmitted with these parameters would use redundancy version parameters s = 1 and r = 0. Note that, by this definition, a UE shall never report a CQI that corresponds to a code rate greater than unity.

   Using this definition of BLER, single-transmission throughput shall be defined as follows :

   $$\text{single-transmission throughput} = (1 - \text{BLER}) \times \text{RTBS}$$

3. The CQI report derived from a given HS-DSCH transmission shall be reported to the NodeB in the next HS-SICH available to the UE following that HS-DSCH transmission, unless that HS-SICH immediately follows the last allocated HS-DSCH timeslot, in which case the subsequent available HS-SICH shall be used by the UE. This HS-SICH may not necessarily be the same HS-SICH that carries the ACK/NACK information for that HS-DSCH transmission. The UE shall always transmit the most recently derived CQI in any given HS-SICH, which may mean that some CQI reports are discarded without being transmitted to the NodeB.

## 5.1.1 Uplink Control

### 5.1.1.1 General limits

By means of higher layer signalling, the Maximum_Allowed_UL_TX_ power for uplink may be set to a value lower than what the terminal power class is capable of. Uplink power control shall be performed while the total UE transmit power is below the maximum allowed output TX power. In some cases the total requested UE transmit power in a timeslot after uplink power control calculation might exceed the maximum allowed output power. In these cases the calculated transmit power of all uplink physical channels in this timeslot shall be scaled by the same amount in dB before transmission in order that the total UE transmission power used shall be the maximum allowed output power.

~~The total transmit power shall not exceed the allowed maximum. If this would be the case, then the transmit power of all uplink physical channels in a timeslot is reduced by the same amount in dB.~~

The UTRAN may not expect the UE to be capable of reducing its total transmit power below the minimum level specified in [2].

### 5.1.1.2 UpPCH

The transmit power for the UpPCH is set by higher layers based on open loop power control as described in [15]

### 5.1.1.3 PRACH

The transmit power for the PRACH is set by higher layers based on open loop power control as described in [15].

### 5.1.1.4 DPCH and PUSCH

The initial transmission power for uplink DPCH and PUSCH is set by higher layers based on open loop power control as described in [15]. The UE then transits into closed loop power control. The node B shall generate TPC commands according to a quality target set by higher layers in order to instruct an increase or decrease in the level of transmission power from the UE and send them in the TPC field of associated downlink CCTrCHs (see [8] for a description of the mapping between DL associated TPC symbols and UL controlled CCTrCH/timeslots). If the physical channel power shall be increased, the TPC command is set to “up”, whereas if the power shall be reduced the command is set to “down”. A TPC command sent in a downlink CCTrCH controls all uplink DPCHs and PUSCHs in the associated uplink CCTrCH and timeslot. An example of SIR based UL power control is given in annex A2~~The closed loop power control makes use of layer 1 symbols in the DPCH and PUSCH. The power control step can take the values 1,2,3 dB within the overall dynamic range 80dB. The initial transmission power for uplink DPCH and PUSCH is signalled by higher layers.~~

~~Closed-loop TPC may be based on SIR. TPC processing procedures are described in the current section.~~

~~The node B should estimate signal-to-interference ratio SIR$_{est}$ of the received uplink DPCH or PUSCH, respectively. The node B should then generate TPC commands and transmit the commands according to the following rule: if SIR$_{est}$ > SIR$_{target}$ then the TPC command to transmit is "down", while if SIR$_{est}$ < SIR$_{target}$ then the TPC command to transmit is "up".~~

At the UE when the TPC command is judged as ‘down’, the mobile transmit power shall be reduced by one power control step, whereas if it is judged as ‘up’, the mobile transmit power shall be raised by one power control step. ~~A higher layer outer loop adjusts the target SIR. This scheme allows quality based power control.~~

The closed loop power control procedure for UL DPCH and PUSCH is not affected by the use of TSTD.

~~An example of UL power control procedure for DPCH is given in Annex A. 2.~~

In the event of no associated uplink data being transmitted between two related downlink TPC commands, the UE shall ignore the resulting TPC command. The transmit power for the next instance of the timeslot/CCTrCH pair shall then be set using the open loop procedure as for initial transmissions.

#### 5.1.1.4.1 Gain Factors

Same as that of 3.84 Mcps TDD, cf. [4.2.2.3.1 Gain Factors].

#### 5.1.1.4.2 Out of synchronization handling

Same as that of 3.84 Mcps TDD, cf.[ 4.2.2.3.2 Out of synchronisation handling].

### 5.1.1.5 HS-SICH

The transmit power of the HS-SICH shall be set by the UE according to the procedures described below. In the case that an ACK is being transmitted on the HS-SICH, the UE shall apply a power offset to the transmit power of the entire HS-SICH. This power offset shall be signalled by higher layers.

On receipt of a TPC command in the HS-SCCH, the UE shall adjust the HS-SICH transmit power according to the power control step size specified by higher layers. However, for the first HS-SICH transmission following the first detected HS-SCCH transmission, or the first HS-SICH transmission following a gap of one or more detected HS-SCCH transmissions to the UE, the UE shall use open loop power control to set the HS-SICH transmit power for that transmission. In this case, the transmission power for HS-SICH is set by higher layers based on open loop power control as described in [15]~~transmit power of the HS-SICH,~~ ~~$P_{HS\text{-}SICH}$,~~ ~~shall be calculated using the following equation:~~

$$\cancel{P_{HS\text{-}SICH} = L_{P\text{-}CCPCH} + PRX_{HS\text{-}SICH,des}}$$

~~where~~ ~~$L_{P\text{-}CCPCH}$~~ ~~is the measured pathloss from the NodeB (based on the P-CCPCH received power level) and~~ ~~$PRX_{HS\text{-}SICH,des}$~~ ~~is the desired receive power level on the HS-SICH when a NAK is being transmitted, which shall be signalled to the UE by higher layers.~~

## 5.1.2 Downlink Control

The total downlink transmission power at the Node B within one timeslot shall not exceed the Maximum Transmission Power set by higher layer signalling.

### 5.1.2.1 P-CCPCH

Same as that of 3.84 Mcps TDD, cf.[4.2.3.1 P-CCPCH].

### 5.1.2.2 The power of the FPACH

The transmit power for the FPACH is set by the higher layer signalling [16].

### 5.1.2.3 S-CCPCH, PICH

Same as that of 3.84 Mcps TDD, cf.[4.2.3.2 S-CCPCH , PICH].

### 5.1.2.4 DPCH, PDSCH

The initial transmission power of the downlink Dedicated Physical Channel is ~~set~~ signalled by ~~the~~ higher layers ~~signalling until the first UL DPCH or PUSCH arrives~~. After the initial transmission, the node B transits into closed-loop TPC. The UE shall generate TPC commands according to a quality target set by higher layers in order to control the level of transmission power from the node B and send them in the TPC field of associated uplink CCTrCHs (see [8] for a description of the mapping between UL associated TPC symbols and DL controlled CCTrCH/timeslots). If the physical channel power should be increased, the TPC command is set to “up”, whereas if the power should be reduced the command is set to “down”. A TPC command sent in an uplink CCTrCH controls all downlink DPCHs or PDSCHs in the associated downlink CCTrCH and timeslot.~~The UE should estimate signal-to-interference ratio $SIR_{est}$ of the received downlink DPCH or PDSCH, respectively. The UE should then generate TPC commands and transmit the commands according to the following rule: if $SIR_{est} > SIR_{target}$ then the TPC command to transmit is "down", while if $SIR_{est} < SIR_{target}$ then the TPC command to transmit is "up".~~

UTRAN may decide how to adjust the transmit power in response to the received TPC command

~~At the Node B when the TPC command is judged as ‘down’, the transmission power may be reduced by one power control step, whereas if judged as ‘up’, the transmission power may be raised by one power control step.~~

When TSTD is applied, the UE can use two consecutive measurements of the received SIR in two consecutive sub-frames to generate the power control command. An example implementation of DL power control procedure for 1.28 Mcps TDD when TSTD is applied is given in Annex A.3.

The transmission power of one DPCH or PDSCH shall not exceed the limits set by higher layer signalling by means of Maximum_DL_Power (dB) and Minimum_DL_Power (dB). The transmission power is defined as the average power over one timeslot of the complex QPSK (or 8PSK respectively) symbols of a single DPCH or PDSCH before spreading relative to the power of the P-CCPCH.

Each TPC command shall be based on all associated downlink transmissions since the previous related TPC command.

In the event of no associated downlink data being transmitted between two related TPC commands, the UTRAN should ignore the resulting TPC command.~~During a downlink transmission pause, the Node B shall ignore TPC commands received during the pause.~~

~~The total downlink transmission power at the Node B within one timeslot shall not exceed Maximum Transmission Power set by higher layer signalling. If the total transmit power of all channels in a timeslot exceeds this limit, then the transmission power of all downlink DPCHs and PDSCHs shall be reduced by the same amount in dB. The value for this power reduction is determined, so that the total transmit power of all channels in this timeslot is equal to the maximum transmission power.~~

#### 5.1.2.4.1 Out of synchronisation handling

Same as that of 3.84 Mcps TDD, cf.[4.2.3.4.1 Out of synchronisation handling].

#### 5.1.2.5 HS-PDSCH

The power control for HS-PDSCH for 1.28 Mcps TDD is the same as for 3.84 Mcps, see section 4.2.3.5

#### 5.1.2.6 HS-SCCH

The power control for HS-SCCH for 1.28 Mcps TDD is the same as for 3.84 Mcps, see section 4.2.3.6

# A.2 Example Implementation of Closed Loop Uplink Power Control in Node B for 1.28 Mcps TDD

Uplink power control is based on a quality target, set by higher layers. An example implementation for a Node B TPC calculation algorithm is SIR based. In this algorithm, an outer loop sets a target SIR value, $SIR_{target}$, which may be adjusted from time to time in order to ensure that the quality target is met. In the meantime, as part of an inner loop a calculation of SIR in associated uplink transmissions may be carried out.~~The measurement of received SIR shall be carried out periodically at Node B.~~ When the measured value is higher than the target SIR value, TPC command = "down". When the measurement is lower than or equal to the target SIR, TPC command = "up".

~~In case of an uplink transmission pause on DPCH, the initial uplink transmission power of DPCH after the pause can be determined by an open loop power control. After the initial transmission after the pause, a closed loop uplink power control procedure can resume.~~

# A.3 Example Implementation of Downlink Power Control in UE for 1.28 -Mcps TDD when TSTD is used

Downlink power control is based on a quality target, set by higher layers. An example implementation for a UE TPC calculation algorithm is SIR based. In this algorithm, an outer loop sets a target SIR value, $SIR_{target}$, which may be adjusted from time to time in order to ensure that the quality target is met. In the meantime, as part of an inner loop a calculation of SIR in associated downlink transmissions may be carried out. When the measured value is higher than the target SIR value, TPC command = "down". When the measurement is lower than or equal to the target SIR, TPC command = "up".

When TSTD is applied, the UE can use the consecutive measurements of SIR to calculate $SIR_{AVG}$:

$$SIR_{AVG}(i) = w_1 SIR(i-1) + w_2 SIR(i),$$

where, $w_1 + w_2 = 1$, $w_1 >= 0$, $w_2 >= 0$, and SIR(i) is the measurement of SIR in sub-frame i and $SIR_{AVG}(i)$ is the measurement of $SIR_{AVG}$ in sub-frame i. If $SIR_{AVG}$ is greater than the target SIR value, TPC command = "down". If the $SIR_{AVG}$ is smaller than the target SIR value, TPC command = "up".

In case of a downlink transmission pause on the DPCH, the example in Annex A.1 can be used for DL power control with $RSCP_{virt}(i)$ and ISCP(i) replaced by $RSCP_{AVG}(i)$ and $ISCP_{AVG}(i)$, where

$$RSCP_{AVG}(i) = w_1 RSCP_{virt}(i-1) + w_2 RSCP_{virt}(i),$$

$$ISCP_{AVG}(i) = w_1 ISCP(i-1) + w_2 ISCP(i).$$

# A.4 Example Implementation of open Loop Power Control for access procedure for 1.28 Mcps TDD

The higher layer signals (on BCH) a power increment that is applied to the SYNC-UL burst only for the access procedure. At each new transmission of a SYNC-UL burst during the access procedure, the transmit power level can be increased by this power increment.