3GPP TSG-RAN Working Group 1 Meeting No. 11
San Diego, USA, 28 FEB 2000 - 03 MAR 2000

Agenda Item: Ad Hoc 1

Source: Siemens

Title: Clarifications on power control for TDD

Document for: Approval

Several refinements are proposed in this CR for approval:

- The Maximum_Allowed_UL_TX_power parameter has been introduced for UL
- The contents of the section on PRACH power control has been removed, since this is contained in 25.331 already.
- Other channels like the PUSCH, PICH and S-CCPCH have been included.
- Maximum and minimum values for the DL power have been included.
- The maximum value for the total DL power has been included.

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Document R1-00-0380
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.

25.224	CR	012rev1	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: RAN#7 *list expected approval meeting # here ↑*

for approval [X] for information [ ]

strategic [ ] non-strategic [ ] *(for SMG use only)*

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: Siemens **Date:** 2000-03-01

Subject: Clarifications on power control procedures

Work item:

Category: *(only one category shall be marked with an X)*

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

Release:

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

Reason for change: Some parts of the power control procedures have to be refined and aligned with higher layer descriptions

Clauses affected: 4.2

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:


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4.2 Transmitter Power Control

4.2.1 General Parameters

Power control is applied for the TDD mode to limit the interference level within the system thus reducing the intercell interference level and to reduce the power consumption in the UE.

All codes within one timeslot allocated to the same CCTrCH use the same transmission power, in case they have the same spreading factor.

Table 1: Transmit Power Control characteristics

	Uplink	Downlink
Power control rate	Variable 1-7 slots delay (2 slot SCH) 1-14 slots delay (1 slot SCH)	Variable, with rate depending on the slot allocation.
Step size		1, 2, 3 dB
Remarks	All figures are without processing and measurement times	Within one timeslot the powers of all active codes may be balanced to within a range of 20 dB

4.2.2 Uplink Control

4.2.2.1 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. 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.

4.2.2.~~2~~1 PRACH~~Common Physical Channel~~

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

~~The transmitter power of UE shall be calculated by the following equation:~~

~~$P_{PRACH} = L_{P\text{-}CCPCH} + I_{BTS} + \text{Constant value}$~~

~~where~~

~~P_{PRACH}: Transmitter power level in dBm,~~

~~$L_{P\text{-}CCPCH}$: Measure representing path loss in dB (reference transmit power is broadcast on BCH),~~

~~I_{BTS}: Interference signal power level at cell's receiver in dBm, which is broadcast on BCH,~~

~~Constant value: This value shall be set by higher Layer (operator matter).~~

4.2.2.~~3~~2 DPCH~~Dedicated Physical Channel~~, PUSCH

~~The initial transmission power is decided in a similar manner as PRACH.~~ After the synchronisation between UTRAN and UE is established, the UE transits into open-loop transmitter power control (TPC).

The transmitter power of UE shall be calculated by the following equation:

$$P_{UE} = \alpha L_{P\text{-}CCPCH} + (1-\alpha)L_0 + I_{BTS} + SIR_{TARGET} + \text{Constant value}$$

where

P_{UE} : Transmitter power level in dBm,

$L_{P\text{-}CCPCH}$: Measure representing path loss in dB (reference transmit power is broadcast on BCH).

L_0: Long term average of path loss in dB

I_{BTS}: Interference signal power level at cell's receiver in dBm, which is broadcast on BCH

α: α is a weighting parameter which represents the quality of path loss measurements. α may be a function of the time delay between the uplink time slot and the most recent down link time slot containing a physical channel that provides the beacon function, see [8]. α is calculated at the UE. An example for calculating α as a function of the time delay is given in Annex 1.

SIR_{TARGET}: Target SNR in dB. A higher layer outer loop adjusts the target SIR.

Constant value: This value shall be set by higher Layer (operator matter) and is broadcast on BCH.~~.~~

If the midamble is used in the evaluation of $L_{P\text{-}CCPCH}$ and L_0, and the Tx diversity scheme used for the P-CCPCH involves the transmission of different midambles from the diversity antennas, the received power of the different midambles from the different antennas shall be combined prior to evaluation of these variables.

4.2.3 Downlink Control

4.2.3.1 P-CCPCH, PICH~~Common Physical Channel~~

The Primary CCPCH transmit power is set by higher layer signalling and can be changed based on network determination on a slow basis. The reference transmit power of the P-CCPCH is signalled on the BCH. The PICH is transmitted with the same power as the P-CCPCH. ~~on a periodic basis.~~

4.2.3.2 S-CCPCH

The relative transmit power of the Secondary CCPCH compared to the P-CCPCH transmit power is set by higher layer signalling.~~.~~

4.2.3.3~~2~~ Dedicated Physical Channel

The initial transmission power of the downlink Dedicated Physical Channel is set by the network. After the initial transmission, the UTRAN transits into SIR-based inner loop power control.~~TPC as similar to the FDD mode~~

The measurement of received SIR shall be carried out periodically at the UE. When the measured value is higher than the target SIR value, TPC command~~bit~~ = "down"~~„0„~~. When this is lower than or equal to ~~than~~ the target SIR value, TPC command~~bit~~ = "up"~~„1„~~. ~~At the UTRAN, soft decision on the TPC bits is performed, and when it is judged as „0„ the transmission power may be reduced by one step, whereas if judged as „1„ the transmission power may be raised by one step.~~

As a response to the received TPC command~~s~~, UTRAN may adjust the transmit power of all downlink DPCHs of this radio link. When the TPC command is judged as "down", the transmission power may be reduced by one step, whereas if judged as "up", the transmission power may be raised by one step. The transmission power of one DPCH~~-~~ 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 of the complex QPSK symbols of a single DPCH before spreading.

The total downlink transmission power at the nodeB within one timeslot shall not exceed Maximum_Transmission_Power set by higher layer signalling. In case the total power of the sum of all transmissions would exceed this limit, then the transmission power of all downlink DPCHs is reduced by the amount that allows fulfilling the requirement. The same amount of power reduction is applied to all DPCHs

~~When the TPC bit cannot be received due to out-of-synchronisation, the transmission power value shall be kept at a constant value. When SIR measurement cannot be performed due to out-of-synchronisation, the TPC bit shall always be = „1„ during the period of being out-of-synchronisation.~~

A higher layer outer loop adjusts the target SIR.