TSG-RAN Working Group 1 AH21 **TSGR1(00)0835**

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Agenda Item: AH21
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To: TSG RAN WG1
Title: Transmit power control for low chip rate TDD option
Document for: Discussion and Approval

Introduction

This document describes the transmit power control procedure for low chip rate TDD option.

Conclusion

It's proposed to discuss and include the following text proposal into the clause 10.1 Transmit Power Control of TR25.928.

---------- changes to TR25.928 begin ----------

10.1 Transmit Power Control

[Description:]

The basic purpose of power control is to limit the interference level within the system thus reducing the intercell interference level and to reduce the power consumption in the UE.

[Rationale:]

10.1.1 General Parameters

The main characteristics of power control are summarized in the following table.

Table -1: Transmit Power Control characteristics

	Uplink	**Downlink**
Power control rate	Variable Closed loop: 0-200 cycles/sec. Open loop: (about 200us – 3575us delay)	Variable closed loop: 0-200 cycles/sec.
Step size	1,2,3 dB (closed loop)	1,2,3 dB (closed loop)
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

Note:

- All codes within one timeslot allocated to the same CCTrCH use the same transmission power in case they have the same Spreading Factor.In case of different spreading factors in the uplink for the same CCtrCH are used , the power levels of the parallel codes portion are under further

study.

10.1.2 Uplink Control

10.1.2.1 Open loop power control for the UpPTS

The transmit power level by a UE on the UpPTS shall be calculated based on the following equation:

$$P_{UpPTS} = L_{P\text{-}CCPCH} + PRX_{UpPTS,des}$$

where, P_{UpPTS} : transmit power level in dBm,
$L_{P\text{-}CCPCH}$: measured path loss in dB (P-CCPCH reference transmit power level is broadcast on BCH),
$PRX_{UpPTS,des}$: desired RX power level at cell's receiver in dBm, which is broadcast on BCH.

The interference power on the UpPTS (I_{UpPTS}) measured by the Node B is reported to the RNC on a regular basis to allow the RNC to make a decision for new control parameters.

The network signals (on BCH) a power increment that is applied only for the access procedure. At each new transmission of a SYNC1 burst during the access procedure, the transmit power level can be increased by this power increment.

10.1.2.2 Common Physical Channel

In low chip rate TDD option system, the F-PACH brings the answer to the SYNC1 burst of the UE. The answer, a one burst long message, shall bring besides the acknowledgment to the received SYNC1 burst, the timing and power level indications to prepare the transmission of the RACH burst.

The transmit power level on the PRACH is calculated by the following equation:

$$P_{PRACH} = L_{P\text{-}CCPCH} + PRX_{PRACH,des}$$

Where, $P_{PRACH}$is the UE transmit power level on the PRACH;
$PRX_{PRACH,des}$ is the desired receive power level on the PRACH, as signalled by the network on the F-PACH

The network computes the $PRX_{PRACH,des}$ by measuring the interference on the PRACH timeslot which has to be averaged over an configurable (by O&M) number of frames (N). .

10.1.2.3 Dedicated Physical Channel

The closed loop power control makes uses of layer 1 symbol in the DPCH. The power control step can take the values 1,2,3 dB within the overall dynamic range 80dB. The initial transmission power of the uplink Dedicated Physical Channel is signalled by the UTRAN.

Closed-loop TPC is based on SIR, and the TPC processing procedures are described in this section. During this power control process, the node B periodically makes a comparison between the received SIR measured value and the target SIR value. When the measured value is higher than the target SIR value, TPC command ='down'. When this is lower than the target SIR value, TPC command = 'up'. At the UE, soft decision on the TPC bits is performed, and when it 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.

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 for being

out-of-synchronisation, the TPC command shall always be set to = ‘up’ during the period of being out-of-synchronisation.

10.1.3 Downlink Control

10.1.3.1 Common Physical Channel

The power of the P-CCPCH

The primary CCPCH transmit power is set by high layer signalling and can be changed based on network determination. The reference power of P-CCPCH is signalled on the BCCH on a periodic basis.

The power of the F-PACH

The power value for the F-PACH is set by the network.

The power of the S-CCPCH

The power of the S-CCPCH (for FACH)

It is set by the network and can take into account both the received power level on the PRACH from the addressed UE and the transmit power level as signalled by the UE.

The power of the S-CCPCH(for PCH)

This condition is the same as P-CCPCH.

10.1.3.2 Dedicated Physical Channel

The initial transmission power of the downlink Dedicated Physical Channel is set by the network until the first UL DPCH arrives. After the initial transmission, the node B transits into SIR-based closed-loop TPC.

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 =’down’. When this is lower than the target SIR value, TPC command = ‘up’. At the Node B, soft decision on the TPC bits is performed, and when it is judged as ‘down’, the transmission power shall be reduced by one power control step, whereas if judged as ‘up’, the transmission power shall be raised by one power control step.

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 command shall always be = ‘up’ during the period of being out-of-synchronisation.

[Explanation difference:]

In low chip rate TDD option, for uplink , the power control update of PRACH can be calculated according to the received power of UpPTS. The power control of the DPCH is closed loop transmitter power control . Closed loop power control in uplink is used because of beamforming. Open loop power control is under consideration if there is no beamforming . For the downlink the transmit power control adjustment of the S-CCPCH(for FACH) can be calculated according the transmit power level signaled in the RACH .

In high chip rate TDD option, for uplink, the power controls of the PRACH and DPCH are open loop transmitter power control. For downlink, the initial transmission power of DPCH is set by the network.

Operation of multiple CCtrCH is under studying.

---------- changes to TR25.928 end ----------