TSG-RAN Working Group1 meeting #5 **TSGR1#5(99)577**

Source: **InterDigital Communications Corporation**

Title: **Text Proposal for S1.24**

Document for: **Decision**

1 Introduction

The following text proposal modifies Section 6.3.3.2 which defines the power control of uplink dedicated physical channel. The changes in 6.3.3.2 apply only to the description of open loop power control. In addition, the following text proposal suggests a text describing the outer loop power control. Here are the issues motivating the text proposal.

- Tdoc R1-99576 shows that power control schemes relying purely on open loop cannot be considered for uplink power control of dedicated channels.
- Tdoc R1-99575 presents a modified version of the open loop schemes – weighted open loop power control, and shows that it outperforms the current (unweighted) open loop power control scheme.

The following text proposal addresses these issues by introducing outer loop power control and weighted open loop power control to the power control of uplink dedicated channels. The proposed outer loop power control is based on CRC detection as in FDD. For completeness the outer loop description of S1.14 is given the appendix.

2 Text Proposal

6.3.3.2 Dedicated Physical Channel

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

UL Open Loop Power Control:
~~The UE transmit power is set based on the measured path loss in the same way as for the PRACH.~~
The transmitter power of UE shall be calculated by the following equation:

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

Where, P_{UE}: transmitter power level in dBm,
L_{CCPCH}: measured path loss in dB (transmit power is broadcasted 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 broadcasted 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.
SIR_{TARGET}: Target SNR in dB. A higher layer outer loop adjusts the target SIR.

Constant value: This value shall be set via Layer 3 message (operator matter).

UL Closed Loop Power Control:
Closed-loop TPC is based on SIR, and the TPC processing procedures are the same as the FDD mode. During this power control process, the NodeB periodically makes a comparison between the received SIR measurement value and the target SIR value. When the measured value is higher than the target SIR value, TPC bit = „0“. When this is lower than the target SIR value, TPC bit = „1“. At the UE, soft decision on the TPC bits is performed, and when it is judged as „0“, the mobile transmit power shall be reduced by one power control step, whereas if it is judged as „1“, the mobile transmit power shall be raised by one TPC 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 bit shall always be = „1“ during the period of being out-of-synchronisation.

Outer Loop Power Control

Outer loop power control shall be based on CRC detection as in FDD.

3 Appendix – Outer Loop Power Control in FDD (Borrowed From S1.14)

< Editor's note: The contents of this clause have been taken from Volume 3 section 3.2.6.7.1.2.2 and XX.07 subclause 4.1.2. Details of outer loop should leave out, since it is a higher layer matter.>
In order to satisfy the required reception quality (average FER, or average BER), the UE should have an outer loop function that updates the reference SIR of fast closed loop and open loop transmitter power control depending on quality information. At the UE, outer loop control is performed based on the quality after maximum ratio combining upon DHO. In soft hand over, the quality threshold for the cells in the active set should be adjusted by the outer loop power control (to be implemented in the network node where soft handover combining is performed).
In outer loop, UE shall update the reference SIR when UE receives a frame that includes an error detection code (CRC). If CRC result is not OK, the reference SIR shall be raised by SIR_{INC} dB. If CRC result is OK, the reference SIR shall be reduced by SIR_{DEC} dB. SIR_{INC} is 0.5 dB (tentative), and SIR_{DEC} is derived from the following equation :

$$SIR_{DEC} = SIR_{INC} \bullet FER_{TARGET} / (1 - FER_{TARGET}) ,$$

where FER_{TARGET} is the target frame error rate. Initial reference SIR (SIR_{INIT}) is dependent on services, and the maximum/minimum value of reference SIR is limited to SIR_{MAX}/SIR_{MIN} dB. SIR_{INIT} ,SIR_{MAX}, and SIR_{MIN} are designated via Layer 3 message. The updates of the reference SIR may be conducted together for N_{ILD} frames when channel interleaving depth is N_{ILD} frames.