TSG-RAN Working Group1 meeting #7 **TSGR1#7(99)A97**

Source: **InterDigital Communications Corporation**

Title: **Comments on Weighted Open Loop Scheme for Uplink Power Control in TDD Mode.**

1 Introduction

In WG1 #6 a new scheme was adopted as a working assumption for uplink power control of dedicated channels in TDD [1]. This scheme combines weighted open loop and outer loop. The weighted open loop is based on path loss estimate. The scheme in [1] assumed that the path loss is estimated as the difference between the transmitted power of the downlink CCPCH broadcasted on the downlink CCPCH and the received power at the UE. However, a concern was raised that the operators will not agree to broadcast the actual transmitted power T_{BTS}. Instead, a reference power $T_{BTS}+\Delta$ with Δ known at NodeB will be transmitted. The new version of TS 25.224 [2] reflects the fact that a reference power for the transmit power is broadcasted on CCPCH. This paper shows that the proposed scheme is not affected by replacing the actual transmitted power by a reference power.

2 Discussion

The power control scheme proposed in [1] is given by,

$$\begin{aligned} P_{UE} &= P_{BTS} + a\left(\hat{L} - L_0\right) + L_0 + \text{Constant value} \\ &= P_{BTS} + a\hat{L} + (1-a)L_0 + \text{Constant value} \\ &= SIR_{TARGET} + I_{BTS} + a\hat{L} + (1-a)L_0 + \text{Constant value} \\ &= SIR_{TARGET} + I_{BTS} + a(T_{BTS} - R_{MS}) + (1-a)L_0 + \text{Constant value} \end{aligned}$$

Denote by P_{UE} the transmitted power of UE in dBm and by P_{BTS} the desired received power at the base station in dBm, which can be expressed by the target signal-to-interference ratio, SIR_{TARGET}, in dB, and the measured interference level at BS, I_{BTS}, in dBm. Let R_{MS} be the received power of the downlink CCPCH and T_{BTS} be the transmitted power of the downlink CCPCH (broadcasted on the down link common channel). Note that T_{BTS}-R_{MS} provides an estimate of the pathloss, $\hat{L}$, in dB. $0 \le a \le 1$ is a weighting factor, which may be determined according to channel conditions, and uplink/downlink delay. L_0 is the long term average of the pathloss in dB. Constant value is a correction term, set via Layer 3 signaling. SIR_{TARGET} is adjusted by higher layer outer loop.

Now assume that instead of broadcasting T_{BTS}, TREF=TBTS+ Δ is broadcasted on the downlink common channel. In that case we can no longer get an estimate of the pathloss L, but a measure representing the pathloss estimate, M =L+Δ. Denote the long-term average of M by M_0. The power control scheme is now given by [2],

$$\begin{aligned} P_{UE} &= P_{BTS} + aM + (1-a)M_0 + \text{Constant value} \\ &= SIR_{TARGET} + I_{BTS} + a\hat{M} + (1-a)M_0 + \text{Constant value} \\ &= SIR_{TARGET} + I_{BTS} + a(T_{REF} - R_{MS}) + (1-a)M_0 + \text{Constant value} \end{aligned}$$

The second line of the above equation can be written as,

$$\begin{aligned} P_{UE} &= SIR_{TARGET} + I_{BTS} + a(\hat{L} + \Delta) + (1-a)(L_0 + \Delta) + \text{Constant value} \\ &= SIR_{TARGET} + I_{BTS} + a\hat{L} + (1-a)L_0 + \text{Constant value} + \Delta \\ &= SIR_{TARGET} + I_{BTS} + a\hat{L} + (1-a)L_0 + \text{New Constant value} \end{aligned}$$

Thus, by appropriately modifying the constant value the modified scheme of [2] is equivalent to the original scheme [1]. In other words, the difference between the transmitted power of the downlink common channel and the broadcastd reference power is absorbed in the constant value.

3 References

[1] Text proposal for 25.224, R1-99A08, InterDigital Communications Corporation.
[2] R1-99A68, 3G TS 25.224 v1.0.1 1999-07, Physical Layer Procedures.