

**Agenda item:**

**Source : NEC**

**Title: Benefits of slow transmit power control**

**Document for: Discussion**

## 1. Introduction

Average transmission power with slow TPC is compared with that with fast closed-loop TPC for the discussions in WG1.

## 2. Average transmission power

Slow transmit power control aims at minimising the transmission on uplink to save battery life. The benefits is explained in this section by comparing average transmission power of UE with slow TPC and that with the fast closed-loop TPC. Assumed system parameters are shown in Table 1. Transmission patterns are shown in Fig. 2. In slow TPC, power control ratios are transmitted with Ack as shown in Fig. 2(a). Relative average transmission powers of UEs with slow TPC (P<sub>pro</sub>) and fast closed-loop TPC (P<sub>cl</sub>) are given as follows:

$$P_{cl} = \{R_d/(R_d+R_c)\} (D_{ack}/T_{ack}) + \{R_c/(R_d+R_c)\}(D_{cl}/T_{cl}) \quad (1)$$

$$P_{pro} = \{R_d/(R_d+R_c)\}(D_{ack}/T_{ack}) + \{R_c/(R_d+R_c)\}(D_{ack}/T_{ack}) = D_{ack}/T_{ack} \quad (2)$$

Figure 3 shows average relative transmission powers assuming that the power for continuous transmission of DPCCH and DPDCH is equal to one. When the DPDCH channel bit rate is 16 kbps, the transmission power with the fast closed-loop TPC is 5.5 times larger than that with slow TPC. Although the difference becomes smaller as the DPDCH channel bit rate becomes higher, the difference is 2 times in the case of 128 kbps. Therefore slow TPC can be an option to reduce consumption power of UE.

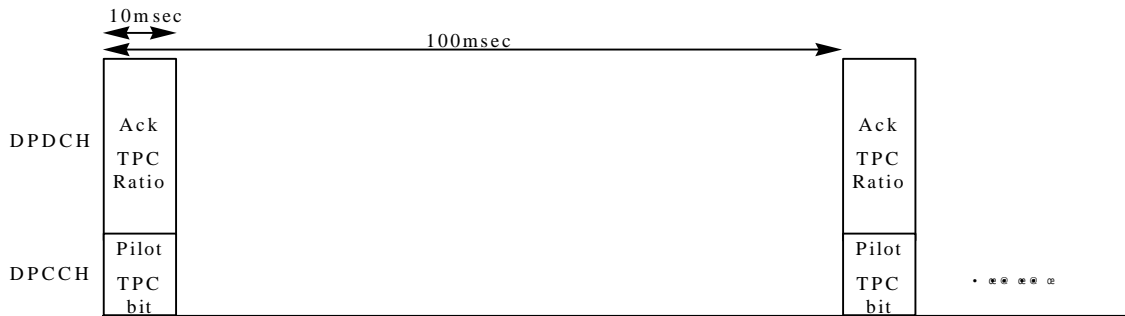
## 3. Conclusions

It is shown that average transmission power is reduced significantly, and thus power consumption is reduced with slow TPC.

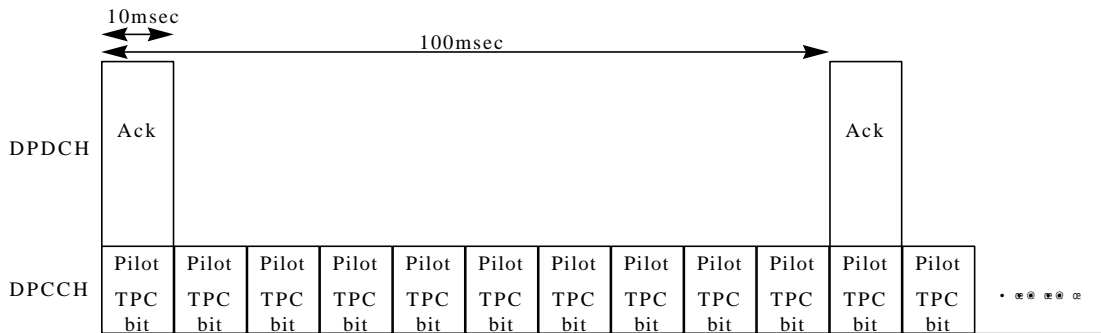
Table 1. System parameters

DPDCH channel bit rate in up-link (R <sub>d</sub> )	16, 32, 64, 128, 256, 512, 1024 kbps
DPCCH channel bit rate in up-link (R <sub>c</sub> )	16 kbps
Transmission time interval of Ack (T <sub>ack</sub> )	100 msec
Transmission time duration of Ack (D <sub>ack</sub> )	10 msec
Transmission time interval of TPC bit in fast closed-loop TPC (T <sub>cl</sub> )	0.625 msec
Transmission time duration of TPC bit in fast	0.625 msec

closed-loop TPC (including pilot symbol) (Dcl)



(a) Slow TPC (Proposed TPC)



(b) Fast closed-loop TPC

Fig. 2 Transmission pattern in up-link

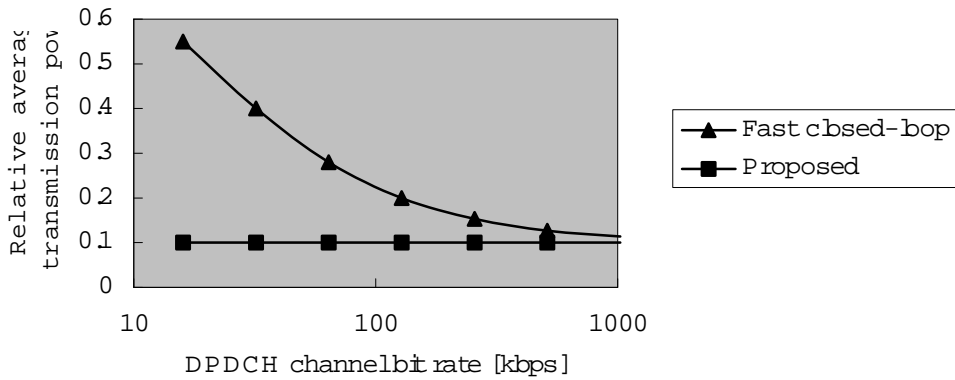


Fig. 3 Relative transmission power of UE