8.7.1 Power Control

In CDMA networks, closed-loop fast transmit power control (TPC) is supported in uplink. The base station estimates the signal-to-interference ratio (C/I), measured in bit energy-to-noise density ratio E_b/N_0, and compares it to a target value (E_b/N_0_*target*). If the estimated C/I is below E_b/N_0_*target*, the base station commands the mobile station to increase the transmit power; if the measured C/I is above E_b/N_0_*target*, it commands the mobile station to lower its power. The fast transmit power control works at a frequency of f Hz (1500 Hz for WCDMA and 800 Hz in CDMA2000 1x), thus the TPC commands are transmitted at 1/f s time intervals (0.667 ms for WCDMA and 1.25 ms for CDMA2000 1x).

In reality, the fast TPC is not ideal because of issues such as

- inaccuracies in the C/I estimates;
- transmit power control signaling errors;
- delay in the transmit power control loop.

Links level simulations take these errors into account and reflect their impacts on the link quality figures in the look up tables to be input to the power control module of SEAMCAT. Therefore, we assume a simple C/I based fast closed-loop TPC of traffic channels for uplink in the following.

In the uplink, each mobile station perfectly achieves the target C/I, Eb/N0_target, during the power control loop convergence, assuming that the maximum transmit (TX) power, max_MS_Tx_Pw, is not exceeded. Those mobile stations not able to achieve Eb/N0_target after convergence of the power control loop are considered in outage.

The local-mean Signal-to-interference power ratio in the uplink, $(C/I)_{UL}$, is calculated by multiplying the received signal power S by the processing gain G, and dividing the result by the total interference power I_{total}

$$\left(\frac{C}{I}\right)_{UL} = \frac{G \cdot S}{I_{total}} \qquad \text{(Eq. 43)}$$

with

$$I_{total} = (1-\beta) \cdot I_{\text{int } ra} + I_{\text{int } er} + I_{out} + N_0 \qquad \text{(Eq. 44)}$$

I_{intra} is the intra-cell interference power, i.e. the interference generated by those mobile stations served by the same base station as the considered mobile station. I_{inter} is the inter-cell interference power from other radio cells. I_{out} is the interference power coming from the interfering system. N_0 is thermal noise (as well as spurious interference) contained in the receiver bandwidth, *W*, and b is an interference reduction factor due to the use of interference mitigation signal processing techniques in the uplink, e.g. Multi User Detection. No such interference mitigation technique is assumed in these considerations, therefore b = 0.

Assuming a mobile station power control range in the order of *MS_PC_Range* dB; the minimum TX power is therefore *max_MS_Pw_Tx – MS_PC_Range* dBm.

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