Technical Specification Group, RAN WG4 *TSGR4#6 (99)402*
Meeting #6, South Queensferry, Scotland, 26 - 29 July 1999

Agenda Item: **8.2**

Source: **Lucent Technologies**

Title: **Simulation, requirements and testability for UE power control**

Document for: **Discussion**

This paper discusses the following aspects of the definition of UE power step size:
- Simulation
- Defining appropriate performance requirements
- Testability of the performance requirements

And the relationship between them.

Simulation and requirements

The purpose of UE power control is to maintain, as far as possible, a constant C/I at the BS receiver.

The current simulation of UE power control in WG1 is investigating the benefit of a small step size, in terms of increased capacity resulting from more accurate control of receiver C/I. A large step size is also required to enable the UE power output to follow rapid changes in path loss. The system performance parameter is the ability of the UE to maintain a constant C/I.

There are a number of reasons why a UE will not be follow exactly the power control commands:
- Step size tolerance
- Settling time
- Overshoot
- Jitter

It should be open to a UE manufacturer to perform a trade-off between these parameters, in order to achieve the specified level of performance.

The performance requirement for the UE should therefore relate to the system requirement (ie the accuracy of maintaining C/I) and not to the individual aspects of implementation (the characteristics of individual power steps). A suitable measure for the accuracy of UE power control is the deviation of the UE output power from the “ideal” value. The capacity reduction of the uplink is the aggregate result of power error of all of the mobiles using a cell. The power errors of these mobiles will be uncorrelated; therefore, the appropriate measure for a single mobile would be the mean power error.

Testability of UE power control

There are two alternative techniques for conformance testing of UE power control, open loop and closed loop. In both cases the test equipment can measure power as a substitute for C/I (as there is only a single UE in the uplink).

Open loop

In this case, the test equipment sends power control commands to the UE, and measures the uplink power.

Advantage: The sequence of power control commands can be determined in advance, and the test equipment does not need to implement closed loop power control

Disadvantage: The power measurement must be accurately calibrated over the range of power control used for a single measurement (note that the full power control range of the UE need not be measured in a single measurement).

Closed loop

In this case, the UE is connected to the test equipment via an attenuator which simulates path loss changes (eg a multipath simulator using one tap) , and the test equipment implements a power control algorithm to maintain a nominally constant power at its input.

Advantage: The dynamic range over which the power measurement must be calibrated is reduced.

Disadvantage: The test equipment must implement closed loop power control.

Recommendations

1) The performance requirement for the UE should be the mean error compared to the ideal envelope for a sequence of power control commands.
2) The simulations being performed in WG1 should generate data in a suitable form to define this requirement.