Agenda item:	**Ad hoc 9**
Source:	**Philips, Nortel**
Title:	**Text proposal for power control in soft handover**
Document for:	**Decision**

Introduction

This text proposal for TS25.214 describes the operation of Algorithm 2 power control during soft handover. It is an addition to [1] which described power control "Algorithm 2" as agreed in WG1 #7 Ad-hoc 9.

This text proposal on algorithm 2 in soft handover takes into account the results presented in [2] and [3].

For consistency, the same text structure is followed as for Algorithm 1.

References

[1]   TSGR1#6(99)d55 *"Text proposal for power control"*, Philips, August 1999

[2]   TSGR1#7(99)c27 *"On the reliability of the emulated small step size during soft handover"*, Nortel, August 1999

[3]   TSGR1#7(99)c47 *"Emulated small step size during soft handover"*, Nortel, August 1999

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5.1.2.2.3 Algorithm 2 for processing TPC commands

Note : Algorithm 2 makes it possible to emulate smaller step sizes than the minimum power control step specified in section 5.1.2.2.1, or to turn off uplink power control by transmitting an alternating series of TPC commands.

< *The use or otherwise of Algorithm 2 in soft handover is FFS.* >

5.1.2.2.3.1 Derivation of TPC_cmd when only one TPC command is received in each slot

When a UE is not in soft handover, only one TPC command will be received in each slot. In this case, the UE shall process received TPC commands on a 5-slot cycle, where the sets of 5 slots shall be aligned to the frame boundaries and there shall be no overlap between each set of 5 slots.

The value of TPC_cmd is derived as follows:

- For the first 4 slots of a set, TPC_cmd = 0.

- For the fifth slot of a set, the UE uses hard decisions on each of the 5 received TPC commands as follows:

    - If all 5 hard decisions within a set are 1 then TPC_cmd = 1 in the 5th slot.

    - If all 5 hard decisions within a set are 0 then TPC_cmd = -1 in the 5th slot.

    - Otherwise, TPC_cmd = 0 in the 5th slot.

5.1.2.2.3.2 Combining of TPC commands known to be the same

When a UE is in soft handover, multiple TPC commands may be received in each slot from different cells in the active set. In some cases, the UE has the knowledge that some of the transmitted TPC commands in a slot are the same. This is the case e.g. with receiver diversity or so called softer handover when the UTRAN transmits the same command in all the serving cells the UE is in softer handover with. For these cases, the TPC commands known to be the same are combined into one TPC command, to be processed and further combined with any other TPC commands as described in subclause 5.1.2.2.3.3.

5.1.2.2.3.3 Combining of TPC commands not known to be the same

In general in case of soft handover, the TPC commands transmitted in the same slot in the different cells may be different.

This subclause describes the general scheme for combination of the TPC commands not known to be the same and then provides an example of such scheme. It is to be further decided what should be subject to detailed standardisation, depending on final requirements. The example might be considered as the scheme from which minimum requirement will be derived or may become the mandatory algorithm.

5.1.2.2.3.3.1 General scheme

The UE shall make a hard decision on the value of each TPC_i, where i = 1, 2, …, N and N is the number of TPC commands not known to be the same, that may be the result of a first phase of combination according to subclause 5.1.2.2.3.2..

The UE shall follow this procedure for 3 consecutive slots, resulting in N hard decisions for each of the 3 slots.

The sets of 3 slots shall be aligned to the frame boundaries and there shall be no overlap between each set of 3 slots.

The value of TPC_cmd is zero for the first 2 slots. After 3 slots have elapsed, the UE shall determine the value of TPC_cmd for the third slot in the following way:

The UE first determines one temporary TPC command, TPC_temp_i, for each of the N sets of 3 TPC commands as follows:

- If all 3 hard decisions within a set are "1", $TPC\_temp_i = 1$

- If all 3 hard decisions within a set are "0", $TPC\_temp_i = -1$

- Otherwise, $TPC\_temp_i = 0$

Finally, the UE derives a combined TPC command for the third slot, TPC_cmd, as a function γ of all the N temporary power control commands TPC_temp_i:

TPC_cmd(3rd slot) = γ (TPC_temp_1, TPC_temp_2, …, TPC_temp_N), where TPC_cmd(3rd slot) can take the values 1, 0 or –1.

5.1.2.2.3.3.2 Example of the scheme

A particular example of the scheme is obtained when using the following definition of the function γ:

TPC_cmd is set to 1 if $\dfrac{1}{N}\sum_{i=1}^{N} TPC\_temp_i > 0.5$.

TPC_cmd is set to -1 if $\dfrac{1}{N}\sum_{i=1}^{N} TPC\_temp_i < -0.5$.

Otherwise, TPC_cmd is set to 0.