Agenda item:

Source: **Philips**

Title: **Combining TPC commands in soft handover**

Document for: **Decision**

Introduction

At RAN1 #11, RAN1 concluded that RAN4 should decide whether any additional clarification is required of the procedure for combining TPC commands in soft handover.

RAN WG4 have now considered the system performance aspects of the current specification in TS25.214 for combining TPC commands in soft handover, and concluded that an additional requirement is necessary in order to specify the required behaviour if the UE receives some reliable TPC commands in soft handover. (see LS [1])

RAN4 recommend that the additional requirement should be as considered at RAN1 #11 in [2], so that the UE shall increase its transmit power in soft handover if the TPC commands from all serving cells are received as reliable "up" commands, and the UE shall decrease its transmit power if the TPC command from any of the serving cells is received as a reliable "down" command.

The attached CR adds this requirement.

References

[1] TSGR1#13(00)0638 *"LS on TPC command combining",* TSG RAN WG4

[2] TSGR1/11(00)0266 *"Clarification of TPC command combining for Algorithm 1 (revised)"*, Philips

3GPP TSG RAN WG1 Meeting #14
Oulu. Finland, 4-7 July, 2000

Document **R1-00-0846**

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.214 CR **113**   Current Version: **3.3.0**

GSM (AA.BB) or 3G (AA.BBB) specification number ↑   *↑ CR number as allocated by MCC support team*

For submission to: **RAN #9**   for approval **X**   strategic ☐   *(for SMG*
list expected approval meeting # here   for information ☐   non-strategic ☐   *use only)*
↑

Form: CR cover sheet, version 2 for 3GPP and SMG   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM ☐   ME **X**   UTRAN / Radio **X**   Core Network ☐
(at least one should be marked with an X)

Source: Philips   **Date:** 2000-06-28

Subject: Combining TPC commands in soft handover

Work item:

Category: F   Correction   **X**   **Release:**   Phase 2   ☐
          A   Corresponds to a correction in an earlier release   ☐   Release 96   ☐
(only one category   B   Addition of feature   ☐   Release 97   ☐
shall be marked   C   Functional modification of feature   ☐   Release 98   ☐
with an X)   D   Editorial modification   ☐   Release 99   **X**
                    Release 00   ☐

Reason for change: RAN WG4 has considered system performance aspects of the current specification for combining TPC commands in soft handover, and concluded that the further requirement needs to be specified.

Clauses affected: 5.1.2.2.2.3

Other specs affected: Other 3G core specifications   ☐   → List of CRs:
          Other GSM core specifications   ☐   → List of CRs:
          MS test specifications   ☐   → List of CRs:
          BSS test specifications   ☐   → List of CRs:
          O&M specifications   ☐   → List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

5.1.2.2.2 Algorithm 1 for processing TPC commands

5.1.2.2.2.1 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 value of TPC_cmd shall be derived as follows:

- If the received TPC command is equal to 0 then TPC_cmd for that slot is –1.

- If the received TPC command is equal to 1, then TPC_cmd for that slot is 1.

5.1.2.2.2.2 Combining of TPC commands from radio links of the same radio link set

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 when the radio links are in the same radio link set. For these cases, the TPC commands from the same radio link set shall be combined into one TPC command, to be further combined with other TPC commands as described in subclause 5.1.2.2.2.3.

5.1.2.2.2.3 Combining of TPC commands from radio links of different radio link sets

This subclause describes the general scheme for combination of the TPC commands from radio links of different radio link sets.

First, the UE shall conduct a soft symbol decision W_i on each of the power control commands TPC_i, where i = 1, 2, …, N, where N is greater than 1 and is the number of TPC commands from radio links of different radio link sets, that may be the result of a first phase of combination according to subclause 5.1.2.2.2.2.

Finally, the UE derives a combined TPC command, TPC_cmd, as a function γ of all the N soft symbol decisions W_i:

- TPC_cmd = γ (W_1, W_2, … W_N), where TPC_cmd can take the values 1 or -1.

The function γ shall fulfil the following criteria:

If the N TPC_i commands are random and uncorrelated, with equal probability of being transmitted as "0" or "1", the probability that the output of γ is equal to 1 shall be greater than or equal to $1/(2^N)$, and the probability that the output of γ is equal to -1 shall be greater than or equal to 0.5. Further, the output of γ shall equal 1 if the TPC commands from all the radio link sets are reliably "1", and the output of γ shall equal –1 if a TPC command from any of the radio link sets is reliably "0".

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 subclause 5.1.2.2.1, or to turn off uplink power control by transmitting an alternating series of TPC commands.

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 shall be 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.