3GPP TSG-RAN Meeting #15 ***RP-020053***
Jeju, Korea, 5 – 8, March, 2002

Title: **Agreed CR (Rel-4) to TS 25.214**

Source: **TSG-RAN WG1**

Agenda item: **7.1.4**

No.	Spec	CR	Rev	R1 T-doc	Subject	Release	Cat	Workitem	V_old	V_new
1	25.214	236	1	R1-02-0489	Clarification of closed loop transmit diversity during soft handover	Rel-4	F	TEI4	4.3.0	4.4.0

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R1-02-0489

CR-Form-v6.1

CHANGE REQUEST

⌘	**25.214**	**CR 236**	⌘ **rev**	**1**	⌘	Current version:	**4.3.0** ⌘
	Spec Title:	Physical layer procedures (FDD)					⌘

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Proposed change affects: ⌘ (U)SIM [ ] ME/UE [X] Radio Access Network [ ] Core Network [ ]

Title:	⌘	Clarification of closed loop transmit diversity during soft handover	
Source:	⌘	TSG RAN WG1	
Work item code:	⌘	TEI4	***Date:*** ⌘ 21 February 2002
Category:	⌘	**F**	***Release:*** ⌘ REL-4
		Use one of the following categories: ***F*** *(correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.	*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change:	⌘	Clarification of UE operation for closed loop transmit diversity during soft handover is desirable subsequent to the recent removal of an example algorithm from section 7.1 to the annex A2. Annex A2 should include an example algorithm for weight calculation in the case of DPCH in combination with DSCH.
Summary of change:	⌘	Clarification in 7.1 that during soft handover the UE should derive the weight vector to maximise the total power from the cells in the active set. Addition of example algorithm for weight calculation in the case of DPCH in combination with DSCH in Annex A2. Isolated impact statement: this CR does not contain any functional changes other than giving new example algorithms for the UE operation during closed loop transmit diversity.
Consequences if not approved:	⌘	Risk that the specification is mis-interpreted resulting in degraded system performance.

Clauses affected:	⌘	7.1, A.2	
Other specs affected:	⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments:	⌘		

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Beginning of part 1…

7 Closed loop mode transmit diversity

The general transmitter structure to support closed loop mode transmit diversity for DPCH transmission is shown in figure 3. Channel coding, interleaving and spreading are done as in non-diversity mode. The spread complex valued signal is fed to both TX antenna branches, and weighted with antenna specific weight factors w_1 and w_2. The weight factors are complex valued signals (i.e., $w_i = a_i + jb_i$), in general.

The weight factors (actually the corresponding phase adjustments in closed loop mode 1 and phase/amplitude adjustments in closed loop mode 2) are determined by the UE, and signalled to the UTRAN access point (=cell transceiver) using the D sub-field of the FBI field of uplink DPCCH.

For the closed loop mode 1 different (orthogonal) dedicated pilot symbols in the DPCCH are sent on the 2 different antennas. For closed loop mode 2 the same dedicated pilot symbols in the DPCCH are sent on both antennas.

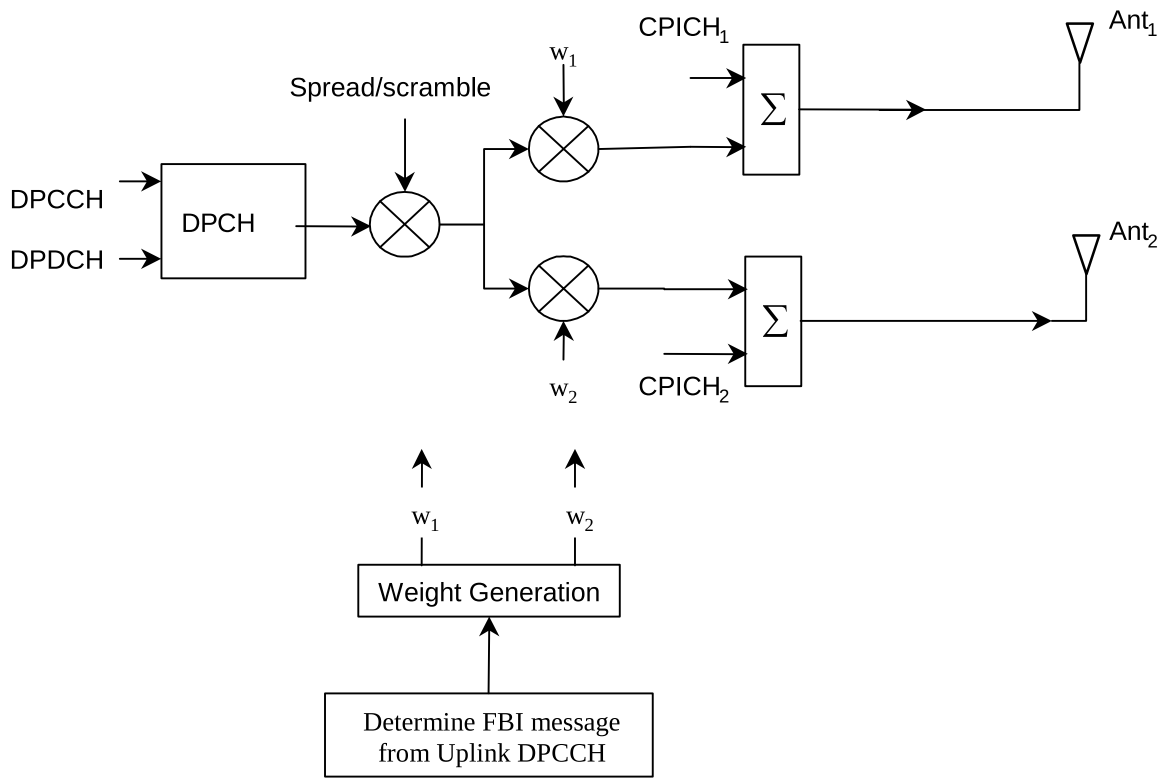

Figure 3: The generic downlink transmitter structure to support closed loop mode transmit diversity for DPCH transmission

There are two closed loop modes whose characteristics are summarised in the table 8. The use of the modes is controlled via higher layer signalling.

Table 8: Summary of number of feedback information bits per slot, N_{FBD}, feedback command length in slots, N_W, feedback command rate, feedback bit rate, number of phase bits, N_{ph}, per signalling word, number of amplitude bits, $N_{po,}$ per signalling word and amount of constellation rotation at UE for the two closed loop modes

Closed loop mode	N_{FBD}	N_W	Update rate	Feedback bit rate	N_{po}	N_{ph}	Constellation rotation
1	1	1	1500 Hz	1500 bps	0	1	π/2
2	1	4	1500 Hz	1500 bps	1	3	N/A

7.1 Determination of feedback information

The UE uses the CPICH to separately estimate the channels seen from each antenna.

Once every slot, the UE computes the phase adjustment, ϕ, and for mode 2 the amplitude adjustment that should be applied at the UTRAN access point to maximise the UE received power. During soft handover, the UE computes the phase adjustment and for mode 2 the amplitude adjustment to maximise the total UE received power from the cells in the active set. In the case that a PDSCH is associated with a DPCH for which closed-loop transmit diversity is applied, the antenna weights applied to the PDSCH are the same as the antenna weights applied to the associated DPCH. In case a PDSCH is associated with a DPCH during soft handover, the UE may emphasize the radio link carrying PDSCH when calculating the antenna weights. An example of how the computations can be accomplished is given in Annex A.2.

The UE feeds back to the UTRAN access point the information on which phase/power settings to use. Feedback Signalling Message (FSM) bits are transmitted in the portion of FBI field of uplink DPCCH slot(s) assigned to closed loop mode transmit diversity, the FBI D field (see [1]). Each message is of length $N_W = N_{po}+N_{ph}$ bits and its format is shown in the figure 4. The transmission order of bits is from MSB to LSB, i.e. MSB is transmitted first. FSM_{po} and FSM_{ph} subfields are used to transmit the power and phase settings, respectively.

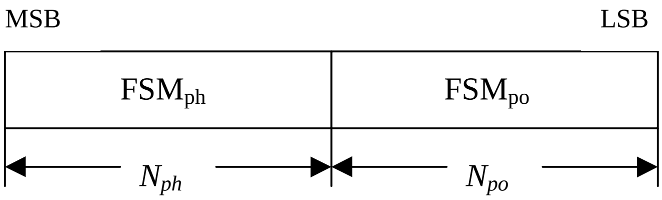

Figure 4: Format of feedback signalling message. FSM_{po} transmits the power setting and FSM_{ph} the phase setting

The adjustments are made by the UTRAN Access Point at the beginning of the downlink DPCCH pilot field. The downlink slot in which the adjustment is done is signalled to L1 of UE by higher layers. Two possibilities exist:

1) When feedback command is transmitted in uplink slot *i*, which is transmitted approximately 1024 chips in offset from the received downlink slot *j*, the adjustment is done at the beginning of the pilot field of the downlink slot (*j*+1) mod 15.

2) When feedback command is transmitted in uplink slot *i*, which is transmitted approximately 1024 chips in offset from the received downlink slot *j*, the adjustment is done at the beginning of the pilot field of the downlink slot (*j*+2) mod 15.

Thus, adjustment timing at UTRAN Access Point is either according to 1) or 2) as controlled by the higher layers.

~~In case a PDSCH is associated with a DPCH for which closed-loop transmit diversity is applied, the antenna weights applied to the PDSCH are the same as the antenna weights applied to the associated DPCH.~~ The timing of the weight adjustment of the PDSCH is such that the PDSCH weight adjustment is done at the PDSCH slot border, N chips after the adjustment of the associated DPCH, where $0 \le N < 2560$.

…End of part 1

Beginning of part 2…

A.2 Computation of feedback information for closed loop transmit diversity

In non-soft handover case, the computation of feedback information can be accomplished by e.g. solving for weight vector, $\underline{w}$, that maximises.

$$P=\underline{w}^H H^H H \underline{w} \qquad (1)$$

where

$H=[\underline{h}_1 \ \underline{h}_2]$ and $\underline{w} = [w_1, w_2]^T$

and where the column vectors $\underline{h}_1$ and $\underline{h}_2$ represent the estimated channel impulse responses for the transmission antennas 1 and 2, of length equal to the length of the channel impulse response. The elements of $\underline{w}$ correspond to the adjustments computed by the UE.

During soft handover, the antenna weight vector, $\underline{w}$ can be, for example, determined so as to maximise the criteria function:

$$P = \underline{w}^H(H_1^H H_1 + H_2^H H_2 + \cdots)\underline{w} \qquad (2)$$

where H_i is an estimated channel impulse response for BS#i. In regular SHO, the set of BS#i corresponds to the active set.

If PDSCH is present, the UE may emphasize the PDSCH serving cell. In this case the antenna weight vector, $\underline{w}$ can be, for example, determined so as to maximise the criteria function:

$$P = \underline{w}^H(\alpha(H_1^H H_1) + (1-\alpha)(H_2^H H_2 + \cdots))\underline{w}$$

where BS#1 is the PDSCH serving cell and coefficient α is less than or equal to 1. For example $\alpha = 0.7$ enhances DSCH performance while ensuring that there is only a small degradation on the DPCH.

…End of part 2