TSG-RAN Working Group 1 meeting #10
Beijing, China
January 18-21, 2000

TSGR1-00-0130

Agenda item:

Source: Ericsson

Title: CR 25.211-024r1 and CR 25.214-047r1: Additional description of TX diversity for PDSCH

Document for: Decision

Currently, there is some information missing regarding closed-loop TX diversity for PDSCH. These change requests clarify some of the missing information:

25.211-024

- It is clarified that a DPCH and an associated PDSCH must use the same TX diversity scheme.

25.214-047

- It is clarified that, in case of closed-loop TX diversity, the anntena weights applied to the PDSCH is *the same* as the antenna weights applied to the associated DPCH, i.e. there is no independent update of the PDSCH weights.
- It is clarified at exactly what point in time, the adjustments to the PDSCH antenna weights take place. It is proposed that this is done at the PDSCH slot boundary.

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Document ????99???
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.

25.211	CR	024r1	Current Version:	3.1.0

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

For submission to:	TSG-RAN #7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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

Source: Ericsson **Date:** 2000-01-11

Subject: Additional description of TX diversity for PDSCH

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: The Change Request clarifies that associated PDSCH and DPCH must use the same TX diversity scheme.

Clauses affected: 5.3.1

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	25.214 CR 047
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:

5.3.1 Downlink Transmit Diversity

Table 10 summarizes the possible application of open and closed loop t~~T~~ransmit diversity modes on different downlink physical channels. Simultaneous use of STTD and closed loop modes on DPCH and PDSCH is not allowed. Furthermore, the transmit diversity mode used for a PDSCH frame shall be the same as the transmit diversity mode used for the DPCH associated with this PDSCH frame. During the duration of the PDSCH frame, and within the slot prior to the PDSCH frame, the transmit diversity mode (open loop or closed loop) on the associated DPCH may not change. However, changing from closed loop mode 1 to mode 2 or vice versa, is allowed.

Table 10: Application of Tx diversity modes on downlink physical channels
"X" – can be applied, "–" – not applied

Channel	Open loop mode		Closed loop
	TSTD	STTD	Mode
P-CCPCH	–	X	–
SCH	X	–	–
S-CCPCH	–	X	–
DPCH	–	X	X
PICH	–	X	–
PDSCH (associated with DPCH)	–	X	X
AICH	–	X	–

5.3.1.1 Open loop transmit diversity

5.3.1.1.1 Space time block coding based transmit antenna diversity (STTD)

The open loop downlink transmit diversity employs a space time block coding based transmit diversity (STTD). The STTD encoding is optional in UTRAN. STTD support is mandatory at the UE. A block diagram of a generic STTD encoder for channel bits b_0, b_1, b_2, b_3 is shown in the figure 7 below. Channel coding, rate matching and interleaving is done as in the non-diversity mode. The bit b_i is real valued {0} for DTX bits and {1, -1} for all other channel bits.

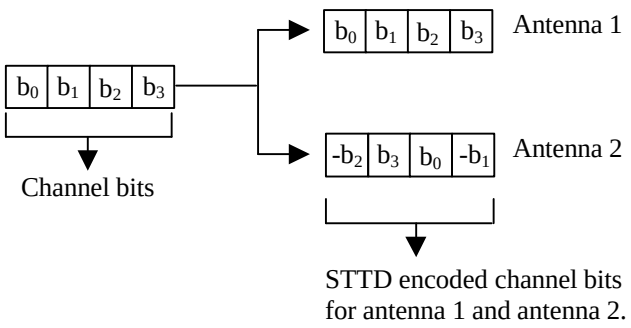

Figure 7: Generic block diagram of the STTD encoder

5.3.1.1.2 Time Switched Transmit Diversity for SCH (TSTD)

Transmit diversity, in the form of Time Switched Transmit Diversity (TSTD), can be applied to the SCH. TSTD for the SCH is optional in UTRAN, while TSTD support is mandatory in the UE. TSTD for the SCH is described in sub-clause 5.3.3.4.1.

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CHANGE REQUEST

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25.214	CR	047r1	Current Version:	3.1.0

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

For submission to:	TSG-RAN #7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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B	Addition of feature	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:
The Change Request clarifies
- that the antenna weights applied to the PDSCH should be the same as the antenna weights applied to the associated DPCH
- exactly when the adjustments of antenna weights takes place for the PDSCH

Clauses affected: 8.1

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	25.211 CR 024
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:

8.1 Determination of feedback information

The UE uses the Common PIlot CHannel (CPICH) to separately estimate the channels seen from each antenna.

Once every slot, the UE computes the phase adjustment, f, and for mode 2 the amplitude adjustment that should be applied at the UTRAN access point to maximise the UE received power. In non-soft handover case, that can be accomplished by e.g. solving for weight vector, $\underline{w}$, that maximises

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

where

$$H=[\underline{h}_1 \ \underline{h}_2 \ldots]$$

and where the column vectors $\underline{h}_i$ and 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 w correspond to the phase and amplitude adjustments computed by the UE.

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

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

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. With SSDT, the set of BS#i corresponds to the primary base station(s).

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 FB Mode Transmit Diversity, the FBI D field (see 25.211). Each message is of length $N_W = N_{po}+N_{ph}$ bits and its format is shown in the figure 7. 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.

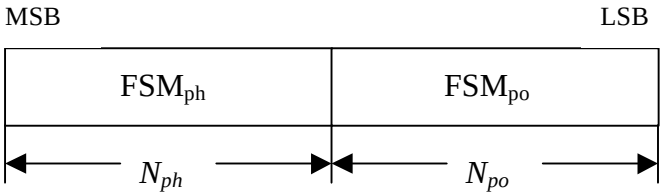

Figure 7: Format of feedback signalling message. FSM_{po} transmits the power setting and FSM_{ph} the phase setting

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 signaled to L1 of UE by higher layers. Two possibilities exist:

1. When feedback command is transmitted in uplink slot *i*, which is transmitted in a chip offset limited to 1024 ± 148 chips when compared to received downlink slot *j*, the adjustment is done at the beginning of the pilot field of the downlink slot (*j*+1) mod 15, or

2. When feedback command is transmitted in uplink slot *i*, which is transmitted in a chip offset limited to 1024 ± 148 chips when compared to received downlink slot *j*, the adjustment is done at the beginning of the pilot field of the downlink slot (*j*+2) mod 15.

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≤N<2560.