TSG-RAN Meeting #14 *RP-010739*
Kyoto, Japan, 11 – 14, December, 2001

Title: **Agreed CRs (R99 and Rel-4 Category A) to TS 25.214**

Source: **TSG-RAN WG1**

Agenda item: **8.1.3**

No.	Spec	CR	Rev	R1 T-doc	Subject	Release	Cat	W/I Code	V_old	V_new
1	25.214	206	1	R1-01-1125	Power control in compressed mode when DPC_MODE=1	R99	F	TEI	3.8.0	3.9.0
2	25.214	207	1	R1-01-1125	Power control in compressed mode when DPC_MODE=1	Rel-4	A	TEI	4.2.0	4.3.0
3	25.214	208	-	R1-01-0993	Clarification of closed loop mode 1 and 2 Tx diversity operation during compressed mode	R99	F	TEI	3.8.0	3.9.0
4	25.214	209	-	R1-01-0993	Clarification of closed loop mode 1 and 2 Tx diversity operation during compressed mode	Rel-4	A	TEI	4.2.0	4.3.0
5	25.214	210	-	R1-01-1122	Downlink phase reference reconfiguration	R99	F	TEI	3.8.0	3.9.0
6	25.214	211	-	R1-01-1122	Downlink phase reference reconfiguration	Rel-4	A	TEI	4.2.0	4.3.0
7	25.214	218	1	R1-01-1251	Downlink power control for channels supporting CPCH	R99	F	TEI	3.8.0	3.9.0
8	25.214	219	1	R1-01-1251	Downlink power control for channels supporting CPCH	Rel-4	A	TEI	4.2.0	4.3.0
9	25.214	222	-	R1-01-1245	Removal of slow power control from TS 25.214	R99	F	TEI	3.8.0	3.9.0
10	25.214	223	-	R1-01-1245	Removal of slow power control from TS 25.214	Rel-4	A	TEI	4.2.0	4.3.0

3GPP TSG RAN Meeting #14
Kyoto, Japan, 11th-14th, December, 2001

R1-01-1125

CR-Form-v5

CHANGE REQUEST

⌘	**25.214**	**CR 206**	⌘ **rev**	**1**	⌘ Current version:	**3.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

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

Title:	⌘	Power control in compressed mode when DPC_MODE=1		
Source:	⌘	TSG RAN WG1		
Work item code:	⌘	TEI	***Date:*** ⌘	November 13th 2001
Category:	⌘	**F** *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.	***Release:*** ⌘	R99 *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:	⌘	TPC command behaviour in the UE and UTRAN when DPC_MODE=1 and compressed mode is activated, is not clearly described
Summary of change:	⌘	This CR clarifies that when compressed mode is activated and DPC_MODE=1, the UE shall generate the TPC commands exactly as in normal mode i.e; repeat the same command over 3 slots. When a transmission gap is scheduled in the uplink this may result in incomplete sets of TPC commands. This does not affect the UE behaviour.
Consequences if not approved:	⌘	Specification of the UE and UTRAN behaviour in compressed mode when DPC_MODE=1 is not complete.

Clauses affected:	⌘	5.1.2.3	
Other specs affected:	⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments:	⌘	Isolated impact CR	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.1.3 Power control in compressed mode

The aim of downlink power control in uplink or/and downlink compressed mode is to recover as fast as possible a signal-to-interference ratio (SIR) close to the target SIR after each transmission gap.

The UE behaviour is the same in compressed mode as in normal mode, described in subclause 5.2.1.2, except that the target SIR is offset by higher layer signalling. However due to transmission gaps in uplink compressed frames there may be incomplete sets of TPC commands when DPC_MODE=1.

UTRAN behaviour is as stated in section 5.2.1.2.2 except for DPC_MODE = 1 where missing TPC commands in the UL may lead the UTRAN to changing its power more frequently than every 3 slots.

In compressed mode, compressed frames may occur in either the uplink or the downlink or both. In compressed frames, the transmission of downlink DPDCH(s) and DPCCH shall be stopped during transmission gaps.

The power of the DPCCH and DPDCH in the first slot after the transmission gap should be set to the same value as in the slot just before the transmission gap.

~~In every slot d~~During compressed mode except during downlink transmission gaps, UTRAN shall estimate the *k*:th TPC command and adjust the current downlink power $P(k-1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$$P(k) = P(k - 1) + P_{TPC}(k) + P_{SIR}(k) + P_{bal}(k),$$

where $P_{TPC}(k)$ is the *k*:th power adjustment due to the inner loop power control, $P_{SIR}(k)$ is the k-th power adjustment due to the downlink target SIR variation, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in [6].

Due to transmission gaps in uplink compressed frames, there may be missing TPC commands in the uplink.

For DPC_MODE = 0 ~~I~~if no uplink TPC command is received, $P_{TPC}(k)$ derived by the Node B shall be set to zero. Otherwise, $P_{TPC}(k)$ is calculated the same way as in normal mode (see sub-clause 5.2.1.2.2) but with a step size Δ_{STEP} instead of Δ_{TPC}.

For DPC_MODE = 1, the sets of slots over which the TPC commands are processed shall remain aligned to the frame boundaries in the compressed frame. If this results in an incomplete set of TPC commands, the UE shall transmit the same TPC commands in all slots of the incomplete set.

The power control step size $\Delta_{STEP} = \Delta_{RP-TPC}$ during RPL slots after each transmission gap and $\Delta_{STEP} = \Delta_{TPC}$ otherwise, where:

- RPL is the recovery period length and is expressed as a number of slots. RPL is equal to the minimum value out of the transmission gap length and 7 slots. If a transmission gap is scheduled to start before RPL slots have elapsed, then the recovery period shall end at the start of the gap, and the value of RPL shall be reduced accordingly.
- Δ_{RP-TPC} is called the recovery power control step size and is expressed in dB. Δ_{RP-TPC} is equal to the minimum value of 3 dB and $2\Delta_{TPC}$.

The power offset $P_{SIR}(k) = \delta P_{curr} - \delta P_{prev}$, where δP_{curr} and δP_{prev} are respectively the value of δP in the current slot and the most recently transmitted slot and δP is computed as follows:

$$\delta P = \max(\Delta P1\_compression, \ldots, \Delta Pn\_compression) + \Delta P1\_coding + \Delta P2\_coding$$

where n is the number of different TTI lengths amongst TTIs of all TrChs of the CCTrCh, where ΔP1_coding and ΔP2_coding are computed from uplink parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1, DeltaSIRafter2 signaled by higher layers as:

- ΔP1_coding = DeltaSIR1 if the start of the first transmission gap in the transmission gap pattern is within the current frame.

- ΔP1coding = DeltaSIRafter1 if the current frame just follows a frame containing the start of the first transmission gap in the transmission gap pattern.

- ΔP2_coding = DeltaSIR2 if the start of the second transmission gap in the transmission gap pattern is within the current frame.

- ΔP2_coding = DeltaSIRafter2 if the current frame just follows a frame containing the start of the second transmission gap in the transmission gap pattern.

- ΔP1_coding = 0 dB and ΔP2_coding = 0 dB in all other cases.

and ΔPi_compression is defined by :

- ΔPi_compression = 3 dB for downlink frames compressed by reducing the spreading factor by 2.

- ΔPi_compression = 10 log ($15*F_i$ / ($15*F_i$ - TGL_i)) if there is a transmission gap created by puncturing method within the current TTI of length F_i frames, where TGL_i is the gap length in number of slots (either from one gap or a sum of gaps) in the current TTI of length F_i frames.

- ΔPi_compression = 0 dB in all other cases.

In case several compressed mode patterns are used simultaneously, a δP offset is computed for each compressed mode pattern and the sum of all δP offsets is applied to the frame.

For all time slots except those in transmissions gaps, the average power of transmitted DPDCH symbols over one timeslot shall not exceed Maximum_DL_Power (dB) by more than P_{SIR}, nor shall it be below Minimum_DL_Power (dB). Transmitted DPDCH symbol means here a complex QPSK symbol before spreading which does not contain DTX. Maximum_DL_Power (dB) and Minimum_DL_Power (dB) are power limits for one channelisation code, relative to the primary CPICH power [6].

3GPP TSG RAN Meeting #14
Kyoto, Japan, 11th-14th, December, 2001

R1-01-1125

CR-Form-v5

CHANGE REQUEST

⌘	25.214	CR	207	⌘ rev	1	⌘	Current version:	4.2.0	⌘

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

Title:	⌘	Power control in compressed mode when DPC_MODE=1
Source:	⌘	TSG RAN WG1
Work item code:	⌘	TEI
Date:	⌘	November 13th 2001
Category:	⌘	**A**
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:	⌘	TPC command behaviour in the UE and UTRAN when DPC_MODE=1 and compressed mode is activated, is not clearly described
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Consequences if not approved:	⌘	Specification of the UE and UTRAN behaviour in compressed mode when DPC_MODE=1 is not complete.

Clauses affected:	⌘	5.1.2.3
Other specs affected:	⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications
Other comments:	⌘	Isolated impact CR

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3GPP TSG RAN Meeting #14
Kyoto, Japan, 11th-14th, December, 2001

R1-01-0993

CR-Form-v4

CHANGE REQUEST

⌘	**25.214**	**CR 208**	⌘ rev	**-**	⌘ Current version:	**3.8.0**	⌘

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

Title: ⌘	Clarification of closed loop mode 1 and 2 Tx diversity operation during compressed mode			
Source: ⌘	TSG RAN WG1			
Work item code: ⌘	TEI		***Date:*** ⌘	25/10/2001
Category: ⌘	**F**		***Release:*** ⌘	R99
	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: ⌘	- Behaviour of NodeB for closed loop transmit diversity operation is currently not defined when uplink only is in compressed mode. - recovery procedure after UL/DL compressed mode not sufficiently specified for closed loop mode 1; if N_{last} = 13, the end of frame adjustment cannot be applied, since FB command not available for slot 13 because of the UL transmission gap
Summary of change: ⌘	- It is clarified what antenna weights shall be applied by NodeB when no feedback information is available during uplink compressed mode. - Closed loop mode 1 recovery after UL/DL compressed mode is clarified for N_{last} = 13 Isolated Impact Analysis : This is an isolated impact CR that corrects a functionality where procedural text or rules were missing from the specification. This CR will not impact the use of any other Rel'99 feature besides closed loop transmit diversity operation in combination with uplink compressed mode.
Consequences if not approved: ⌘	Node B behaviour will remain unclear and may cause a degradation of DL transmission quality

Clauses affected: ⌘	7.2 and 7.3	
Other specs Affected: ⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	
Other comments: ⌘		

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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., $w_i = a_i + \mathrm{j}b_i$), 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.

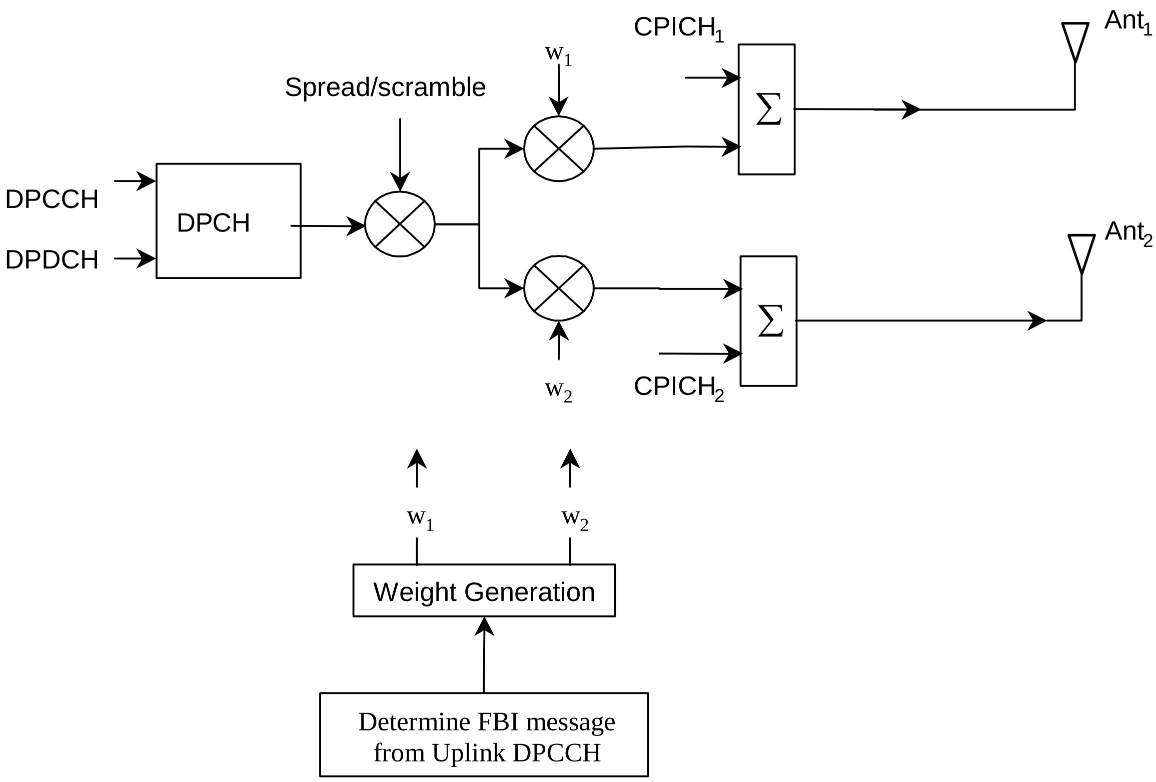

Figure 3: The generic downlink transmitter structure to support closed loop mode transmit diversity for DPCH transmission

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	$\pi/2$
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. 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.

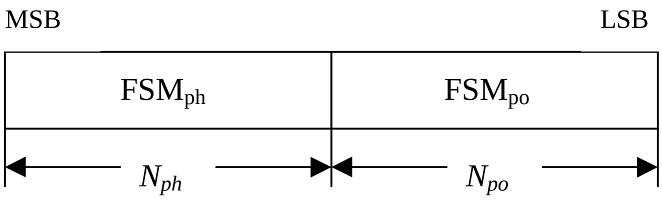

Figure 4: Format of feedback signalling message. FSM_{po} transmits the power setting and FSM_{ph} the phase setting

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 $0 \le N < 2560$.

7.2 Closed loop mode 1

The UE uses the CPICH transmitted both from antenna 1 and antenna 2 to calculate the phase adjustment to be applied at UTRAN access point to maximise the UE received power. In each slot, UE calculates the optimum phase adjustment, ϕ, for antenna 2, which is then quantized into ϕ_Q having two possible values as follows:

$$\phi_Q = \begin{cases} \pi, & \text{if } \pi/2 < \phi - \phi_r(i) \le 3\pi/2 \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

where:

$$\phi_r(i) = \begin{cases} 0, & i = 0,2,4,6,8,10,12,14 \\ \pi/2, & i = 1,3,5,7,9,11,13 \end{cases} \quad (2)$$

If $\phi_Q = 0$, a command '0' is send to UTRAN using the FSM_{ph} field. Correspondingly, if $\phi_Q = \pi$, command '1' is send to UTRAN using the FSM_{ph} field.

Due to rotation of the constellation at UE the UTRAN interprets the received commands according to table 9 which shows the mapping between phase adjustment, ϕ_i, and received feedback command for each uplink slot.

Table 9: Phase adjustments, ϕ_i, corresponding to feedback commands for the slots *i* of the UL radio frame

Slot #		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FSM	0	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0
	1	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π

The weight w_2 is then calculated by averaging the received phases over 2 consecutive slots. Algorithmically, w_2 is calculated as follows:

$$w_2 = \frac{\sum_{i=n-1}^{n} \cos(\phi_i)}{2} + j\frac{\sum_{i=n-1}^{n} \sin(\phi_i)}{2} \qquad (3)$$

where:

$$\phi_i \in \{0, \pi, \pi/2, -\pi/2\} \qquad (4)$$

For antenna 1, w_1 is constant:

$$w_1 = 1/\sqrt{2} \qquad (5)$$

7.2.1 Mode 1 end of frame adjustment

In closed loop mode 1 at frame borders the averaging operation is slightly modified. Upon reception of the FB command for slot 0 of a frame, the average is calculated based on the command for slot 13 of the previous frame and the command for slot 0 of the current frame, i.e. ϕ_i from slot 14 is not used:

$$w_2 = \frac{\cos(\phi_{13}^{j-1}) + \cos(\phi_0^j)}{2} + j\frac{\sin(\phi_{13}^{j-1}) + \sin(\phi_0^j)}{2} \qquad (6)$$

where:

- ϕ_{13}^{j-1} = phase adjustment from frame j-1, slot 13.
- ϕ_0^j = phase adjustment from frame j, slot 0.

7.2.2 Mode 1 normal initialisation

For the first frame of transmission UE determines the feedback commands in a normal way and sends them to UTRAN.

Before the first FB command is received, the UTRAN shall use the initial weight $w_2 = \frac{1}{2}(1+j)$.

Having received the first FB command the UTRAN calculates w_2 as follows:

$$w_2 = \frac{\cos(\pi/2) + \cos(\phi_0)}{2} + j\frac{\sin(\pi/2) + \sin(\phi_0)}{2} \qquad (7)$$

where:

ϕ_0 = phase adjustment from slot 0 of the first frame.

7.2.3 Mode 1 operation during compressed mode

7.2.3.1 Downlink in compressed mode and uplink in normal mode

When downlink is in compressed mode but uplink is operating normally (i.e. not compressed) the UTRAN continues it's Tx diversity related functions in the same way as in non-compressed downlink mode.

In downlink transmission gaps there are uplink slots for which no new estimate of the phase adjustment is calculated. During these slots the following rules are applied in UE when determining the feedback command:

1) If no new estimate of phase adjustment ϕ_i exists corresponding to the feedback command to be sent in uplink slot *i*:

- If $1 < i < 15$:
  - the feedback command sent in uplink slot i-2 is used;
- else if $i = 0$:
  - the feedback command sent in uplink slot 14 of previous frame is used;
- else if $i = 1$:
  - the feedback command sent in uplink slot 13 of previous frame is used;
- end if.

2) When transmission in downlink is started again in downlink slot N_{last}+1 (if N_{last}+1 = 15, then slot 0 in the next frame) the UE must resume calculating new estimates of the phase adjustment. The feedback command corresponding to the first new estimate of ϕ_i must be sent in the uplink slot which is transmitted approximately 1024 chips in offset from the downlink slot N_{last}+1.

7.2.3.2 Both downlink and uplink in compressed mode

During the uplink transmission gaps no FB commands are sent from UE to UTRAN. When transmission in downlink is started again in downlink slot N_{last}+1 (if N_{last}+1 = 15, then slot 0 in the next frame) the UE must resume calculating new estimates of the phase adjustment. The feedback command corresponding to the first new estimate of ϕ_i must be sent in the uplink slot which is transmitted approximately 1024 chips in offset from the downlink slot N_{last}+1.

The UTRAN continues to update the weight w_2 until the uplink transmission gap starts and no more FB commands are received. When the transmission in downlink resumes in slot N_{last}+1, the value of w_2, calculated after receiving the last FB command before the start of the uplink transmission gap, is applied to antenna 2 signal.

After the UE resumes transmission in uplink and sends the first FB command, the new value of w_2 is calculated as follows:

- S_1 = {0, 2, 4, 6, 8, 10, 12 14}.
- S_2 = {1, 3, 5, 7, 9, 11, 13}.
- i = number of uplink slot at which the transmission resumes.
- j = number of uplink slot at which the last FB command was sent before the start of the uplink transmission gap.
- Do while ($i \in S_1$ *and* $j \in S_1$) or ($i \in S_2$ *and* $j \in S_2$):
  - j = j-1;
  - if j < 0;
  - j = 14;
- end if;
- end do;
- calculate w_2 based on FB commands received in uplink slots i and j.

Note that for N_{last} = 13 the end of frame adjustment procedure shall be based on the FB commands for the last odd slot prior to the uplink transmission gap and slot 0.

7.2.3.3 Uplink in compressed mode and downlink in normal mode

The UTRAN continues to update the value of w_2 until the uplink transmission gap starts and no more FB commands are received. Then, the value of w_2 calculated after receiving the last FB command before the uplink transmission gap is applied to the antenna 2 signal. When the UE resumes transmission in uplink, it shall send FB commands according to section 7.2 equations 2 and 3 (normal operation) and the UTRAN Access Point shall interpret the FB commands according to Table 9.

The calculation of w_2 by the UTRAN following the uplink transmission gap, and before the first two FB commands following the gap are received is not specified.

7.2.4 Mode 1 initialisation during compressed mode

7.2.4.1 Downlink in compressed mode

When closed loop mode 1 is initialised during the downlink transmission gap of compressed mode there are slots for which no estimate of the phase adjustment is calculated and no previous feedback command is available.

In this case, if the UE is required to send feedback in the uplink, the FB command to the UTRAN shall be '0'.

When transmission in downlink is started again in slot N_{last}+1 (if N_{last}+1 = 15, then slot 0 in the next frame), the UTRAN shall use the initial weight $w_2 = \frac{1}{2}(1+j)$. The UE must start calculating estimates of the phase adjustment.

The feedback command corresponding to the first estimate of ϕ_i must be sent in the uplink slot which is transmitted approximately 1024 chips in offset from the downlink slot N_{last}+1. Having received this feedback command the UTRAN calculates w_2 as follows:

$$w_2 = \frac{\cos(\phi_i)+\cos(\phi_j)}{2} + j\frac{\sin(\phi_i)+\sin(\phi_j)}{2} \qquad (8)$$

where:

ϕ_i = phase adjustment in uplink slot i , which is transmitted approximately 1024 chips in offset from the downlink slot N_{last}+1.

$\phi_j = \frac{\pi}{2}$, if slot i is even ($i \in \{0, 2, 4, 6, 8, 10, 12, 14\}$) and

$\phi_j = 0$, if slot i is odd ($i \in \{1, 3, 5, 7, 9, 11, 13\}$)

7.2.4.2 Uplink in compressed mode

Initialisation of closed loop mode 1 operation during uplink compressed mode only is not specified.

7.3 Closed loop mode 2

In closed loop mode 2 there are 16 possible combinations of phase and power adjustment from which the UE selects and transmits the FSM according to table 10 and table 11. As opposed to closed loop Mode 1, no constellation rotation is done at UE and no filtering of the received weights is performed at the UTRAN.

Table 10: FSM_{po} subfield of closed loop mode 2 signalling message

FSM_{po}	Power_ant1	Power_ant2
0	0.2	0.8
1	0.8	0.2

Table 11: FSM_{ph} subfield of closed loop mode 2 signalling message

FSM_{ph}	Phase difference between antennas (radians)
000	π
001	$-3\pi/4$
011	$-\pi/2$
010	$-\pi/4$
110	0
111	$\pi/4$
101	$\pi/2$
100	$3\pi/4$

To obtain the best performance, progressive updating is performed at both the UE and the UTRAN Access point. The UE procedure shown below is an example of how to determine FSM at UE. Different implementation is allowed. Every slot time, the UE may refine its choice of FSM, from the set of weights allowed given the previously transmitted bits of the FSM. This is shown in figure 5, where, in this figure b_i ($0 \le i \le 3$) are the bits of the FSM (from table 10 and table 11) from the MSB to the LSB and m=0, 1, 2, 3 (the end of frame adjustment given in subclause 7.3.1 is not shown here).

At the beginning of a FSM to be transmitted, the UE chooses the best FSM out of the 16 possibilities. Then the UE starts sending the FSM bits from the MSB to the LSB in the portion of FBI field of the uplink DPCCH during 4 (FSM message length) slots. Within the transmission of the FSM the UE refines its choice of FSM. This is defined in the following:

- define the 4 bits of FSM, which are transmitted from slot number k to k+3, as $\{b_3(k)\ b_2(k+1)\ b_1(k+2)\ b_0(k+3)\}$, where k=0, 4, 8, 12. Define also the estimated received power criteria defined in Equation 1 for a given FSM as $P(\{x_3, x_2\ x_1\ x_0\})$, where $\{x_3\ x_2\ x_1\ x_0\}$ is one of the 16 possible FSMs which defines an applied phase and power offset according to table 10 and table 11. The $b_i()$ and x_i are 0 or 1.

The bits transmitted during the m'th FSM of the frame, where m=0,1,2,3, are then given by:

$b_3(4m)=X_3$ from the $\{X_3\ X_2\ X_1\ X_0\}$ which maximises $P(\{x_3\ x_2\ x_1\ x_0\})$ over all x_3,x_2,x_1,x_0 (16 possible combinations);

$b_2(4m+1)=X_2$ from the $\{b_3(4m)\ X_2\ X_1\ X_0\}$ which maximises $P(\{b_3(4m)\ x_2\ x_1\ x_0\})$ over all x_2,x_1,x_0 (8 possible combinations);

$b_1(4m+2)=X_1$ from the $\{b_3(4m)\ b_2(4m+1)\ X_1\ X_0\}$ which maximises $P(\{b_3(4m)\ b_2(4m+1)\ x_1\ x_0\})$ over all x_1,x_0 (4 possible combinations);

$b_0(4m+3)=X_0$ from the $\{b_3(4m)\ b_2(4m+1)\ b_1(4m+2)\ X_0\}$ which maximises $P(\{b_3(4m)\ b_2(4m+1)\ b_1(4m+2)\ x_0\})$ over x_0 (2 possible combinations).

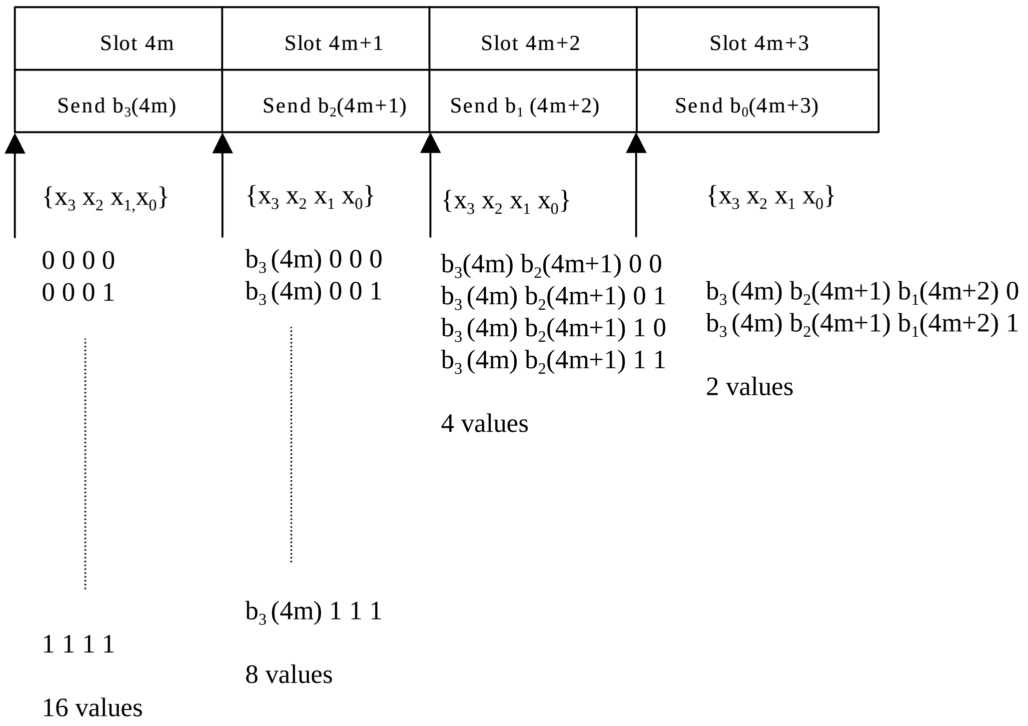

Figure 5: Progressive Refinement at the UE for closed loop mode 2

Every slot time the UTRAN constructs the FSM from the most recently received bits for each position in the word and applies the phase and amplitude (derived from power) as defined by table 10 and table 11. More precisely, the UTRAN operation can be explained as follows. The UTRAN maintains a register **z**={z_3 z_2 z_1 z_0}, which is updated every slot time according to z_i=b_i(ns) (i=0:3, ns=0:14). Every slot time the contents of register **z** are used to determine the phase and power adjustments as defined by table 10 and table 11, with FSM_{ph} ={z_3 z_2 z_1} and FSM_{po}=z_0.

Special procedures for initialisation and end of frame processing are described below.

The weight vector, $\underline{w}$, is then calculated as:

$$\underline{w} = \begin{bmatrix} \sqrt{power\_ant1} \\ \sqrt{power\_ant2}\,\exp(j\ phase\_diff) \end{bmatrix} \tag{9}$$

7.3.1 Mode 2 end of frame adjustment

The FSM must be wholly contained within a frame. To achieve this an adjustment is made to the last FSM in the frame where the UE only sends the FSM_{ph} subfield, and the UTRAN takes the power bit FSM_{po} of the previous FSM.

7.3.2 Mode 2 normal initialisation

For the first frame of transmission using closed loop mode 2, the operation is as follows.

The UE starts sending the FSM message from slot 0 in the normal way. The UE may refine its choice of FSM in slots 1 to 3 from the set of weights allowed given the previously transmitted bits of the FSM.

The UTRAN Access Point operation is as follows. Until the first FSM_{po} bit is received and acted upon (depending on the timing control specified via the higher layer parameter described in section 7.1) the power in both antennas shall be set to 0.5. Until the first FSM_{ph} bit is received and acted upon the phase difference between antennas shall be π radians.

The phase offset applied between the antennas is updated according to the number and value of FSM_{ph} bits received as given in table 12.

Table 12: FSM_{ph} normal initialisation for closed loop mode 2

FSM_{ph}	Phase difference between antennas (radians)
- - -	π (normal initialisation) or held from previous setting (compressed mode recovery)
0 - -	π
1 - -	0
0 0 -	π
0 1 -	-π/2
1 1 -	0
1 0 -	π/2
0 0 0	π
0 0 1	-3π/4
0 1 1	-π/2
0 1 0	-π/4
1 1 0	0
1 1 1	π/4
1 0 1	π/2
1 0 0	3π/4

This operation applies in both the soft handover and non soft handover cases.

7.3.3 Mode 2 operation during compressed mode

7.3.3.1 Downlink in compressed mode and uplink in normal mode

When the downlink is in compressed mode and the uplink is in normal mode, the closed loop mode 2 functions are described below.

When the UE is not listening to the CPICH from antennas 1 and 2 during the downlink transmission gap, the UE sends the last FSM bits calculated before the start of the downlink transmission gap.

Recovery from compressed mode is described in the following. Downlink transmissions commence at the pilot field of slot Nlast as described in [2].

After a transmission gap, UTRAN Access Point sets the power in both antennas to 0.5 until a FSM_{po} bit is received and acted upon. Until the first FSM_{ph} bit is received and acted upon, UTRAN uses the phase offset, which was applied before the transmission interruption (table 12).

If the uplink slot Nlast+1 (modulo 15) occurs at the beginning of a FSM period (that is at slot 0,4,8,or 12), the UE sends the FSM message in the normal way, with 3 FSM_{ph} bits and with the FSM_{po} bit on slot 3, 7 or 11, and the UTRAN Access Point acts on the FSM_{ph} bits according to table 12.

If the uplink slot Nlast+1 (modulo 15) does not occur at the beginning of a FSM period, the following operation is performed. In each of the remaining slots of the partial FSM period, that is from slot Nlast+1 (modulo 15) until the final slot (slot 3, 7, 11or 14), and for the first slot of the next full FSM period, the UE sends the first (i.e. MSB) bit of the FSM_{ph} message, and at the UTRAN access point the phase offset applied between the antennas is updated according to the number and value of FSM_{ph} bits received as given in table 13. During the following full FSM period, which starts on slot 0, 4, 8, or 12, the UE sends the FSM message in the normal way, with 3 FSM_{ph} bits and with the FSM_{po} bit on slot 3, 7 or 11, and the UTRAN Access Point acts on the FSM_{ph} bits according to table 12.

Table 13: FSM_{ph} subfield of closed loop mode 2 in compressed mode recovery period

FSM_{ph}	Phase difference between antennas (radians)
-	held from previous setting
0	π
1	0

7.3.3.2 Both downlink and uplink in compressed mode

During both downlink and uplink compressed mode, the UTRAN and the UE performs the functions of recovery after transmission gaps as described in the previous subclause 7.3.3.1.

7.3.3.3 Uplink in compressed mode and downlink in normal mode

The UTRAN continues to update the weight vector *w* until the uplink transmission gap starts and no more FSM bits are received. Then, UTRAN Access Point continues to apply the weight vector *w*, which was used before the transmission gap. When the UE resumes transmission in uplink, it chooses FSM according to normal operation as described in section 7.3 and 7.3.1. If the uplink signalling does not resume at the beginning of a FSM period, the UE shall calculate the remaining FSM bits according to section 7.3, using the last FSM(s) sent before the uplink gap as the "previously transmitted bits of the FSM".

The calculation of the phase adjustment by UTRAN remains unspecified until all 3 FSM_{ph} bits have been received following the uplink transmission gap. The calculation of the power adjustment by UTRAN remains unspecified until an FSM_{po} bit has been received following the uplink transmission gap.

7.3.4 Mode 2 initialisation during compressed mode

7.3.4.1 Downlink in compressed mode

When closed loop mode 2 is initialised during the downlink transmission gap of compressed mode there are slots for which no FSM bit is calculated and no previous sent FSM bit is available.

In this case, if the UE is required to send feedback in the uplink, the FB command to the UTRAN shall be '0'.

The UTRAN and the UE perform the functions of recovery after the downlink transmission gap as described in the previous subclause 7.3.3.1. If no previous phase setting is available, UTRAN shall use the phase offset π, until the first FSM_{ph} bit is received and acted upon.

7.3.4.2 Uplink in compressed mode

Initialisation of closed loop mode 2 operation during uplink compressed mode only is not specified.

R1-01-0993

CR-Form-v4

CHANGE REQUEST

⌘	**25.214**	**CR**	**209**	⌘ rev	**-**	⌘	Current version:	**4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

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

Title:	⌘	Clarification of closed loop mode 1 and 2 Tx diversity operation during compressed mode	
Source:	⌘	TSG RAN WG1	
Work item code:	⌘	TEI	***Date:*** ⌘ 25/10/2001
Category:	⌘	**A**	***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:	⌘	- Behaviour of NodeB for closed loop transmit diversity operation is currently not defined when uplink only is in compressed mode. - recovery procedure after UL/DL compressed mode not sufficiently specified for closed loop mode 1; if N_{last} = 13, the end of frame adjustment cannot be applied, since FB command not available for slot 13 because of the UL transmission gap
Summary of change:	⌘	- It is clarified what antenna weights shall be applied by NodeB when no feedback information is available during uplink compressed mode. - Closed loop mode 1 recovery after UL/DL compressed mode is clarified for N_{last} = 13 Isolated Impact Analysis : This is an isolated impact CR that corrects a functionality where procedural text or rules were missing from the specification. This CR will not impact the use of any other Rel'99 feature besides closed loop transmit diversity operation in combination with uplink compressed mode.
Consequences if not approved:	⌘	Node B behaviour will remain unclear and may cause a degradation of DL transmission quality

Clauses affected:	⌘	7.2 and 7.3	
Other specs Affected:	⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments:	⌘		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

   3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

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.

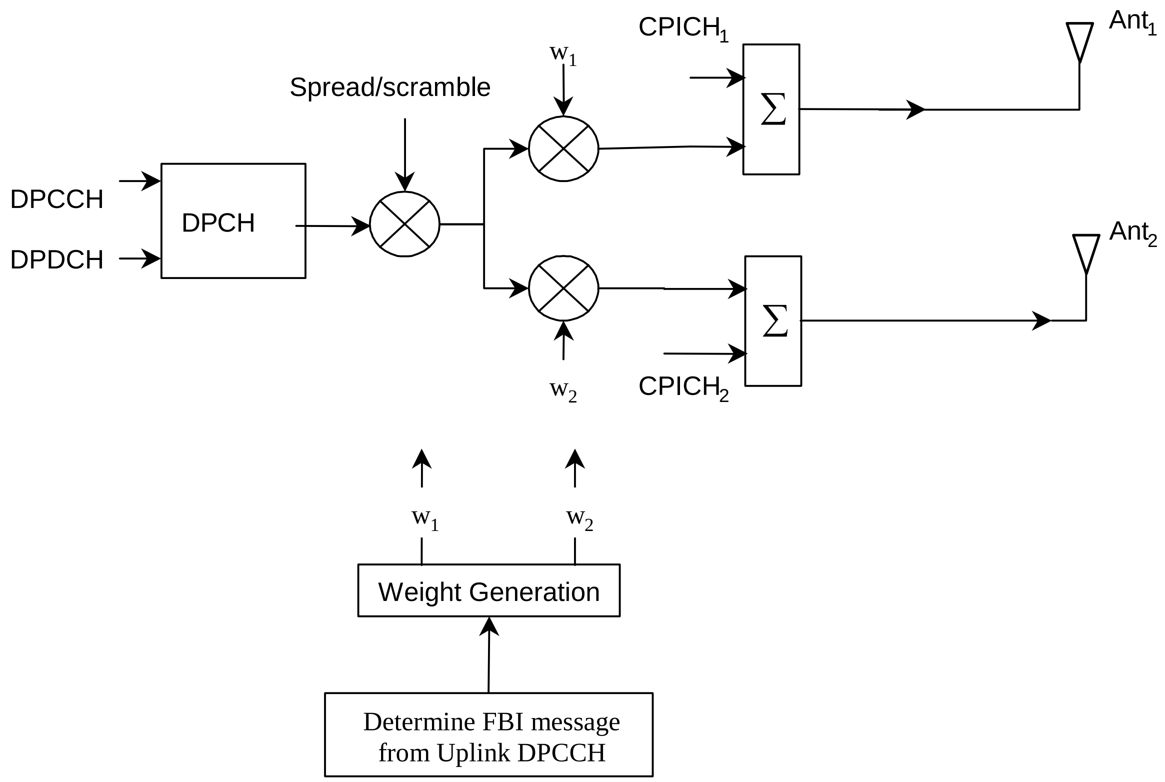

Figure 3: The generic downlink transmitter structure to support closed loop mode transmit diversity for DPCH transmission

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	$\pi/2$
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. 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.

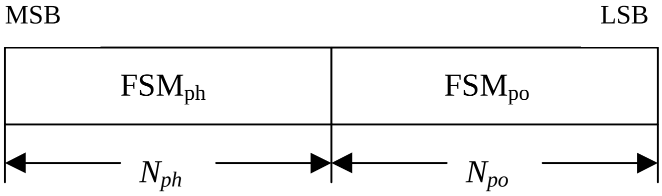

Figure 4: Format of feedback signalling message. FSM_{po} transmits the power setting and FSM_{ph} the phase setting

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 $0 \le N < 2560$.

7.2 Closed loop mode 1

The UE uses the CPICH transmitted both from antenna 1 and antenna 2 to calculate the phase adjustment to be applied at UTRAN access point to maximise the UE received power. In each slot, UE calculates the optimum phase adjustment, ϕ, for antenna 2, which is then quantized into ϕ_Q having two possible values as follows:

$$\phi_Q = \begin{cases} \pi, & \text{if } \pi/2 < \phi - \phi_r(i) \le 3\pi/2 \\ 0, & \text{otherwise} \end{cases} \qquad (1)$$

where:

$$\phi_r(i) = \begin{cases} 0, & i = 0,2,4,6,8,10,12,14 \\ \pi/2, & i = 1,3,5,7,9,11,13 \end{cases} \qquad (2)$$

If $\phi_Q = 0$, a command '0' is send to UTRAN using the FSM_{ph} field. Correspondingly, if $\phi_Q = \pi$, command '1' is send to UTRAN using the FSM_{ph} field.

Due to rotation of the constellation at UE the UTRAN interprets the received commands according to table 9 which shows the mapping between phase adjustment, ϕ_i, and received feedback command for each uplink slot.

Table 9: Phase adjustments, ϕ_i, corresponding to feedback commands for the slots *i* of the UL radio frame

Slot #		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FSM	0	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0	π/2	0
	1	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π	-π/2	π

The weight w_2 is then calculated by averaging the received phases over 2 consecutive slots. Algorithmically, w_2 is calculated as follows:

$$w_2 = \frac{\sum_{i=n-1}^{n} \cos(\phi_i)}{2} + j\frac{\sum_{i=n-1}^{n} \sin(\phi_i)}{2} \quad (3)$$

where:

$$\phi_i \in \{0, \pi, \pi/2, -\pi/2\} \quad (4)$$

For antenna 1, w_1 is constant:

$$w_1 = 1/\sqrt{2} \quad (5)$$

7.2.1 Mode 1 end of frame adjustment

In closed loop mode 1 at frame borders the averaging operation is slightly modified. Upon reception of the FB command for slot 0 of a frame, the average is calculated based on the command for slot 13 of the previous frame and the command for slot 0 of the current frame, i.e. ϕ_i from slot 14 is not used:

$$w_2 = \frac{\cos(\phi_{13}^{j-1}) + \cos(\phi_0^j)}{2} + j\frac{\sin(\phi_{13}^{j-1}) + \sin(\phi_0^j)}{2} \quad (6)$$

where:

- ϕ_{13}^{j-1} = phase adjustment from frame j-1, slot 13.
- ϕ_0^j = phase adjustment from frame j, slot 0.

7.2.2 Mode 1 normal initialisation

For the first frame of transmission UE determines the feedback commands in a normal way and sends them to UTRAN.

Before the first FB command is received, the UTRAN shall use the initial weight $w_2 = \frac{1}{2}(1+j)$.

Having received the first FB command the UTRAN calculates w_2 as follows:

$$w_2 = \frac{\cos(\pi/2) + \cos(\phi_0)}{2} + j\frac{\sin(\pi/2) + \sin(\phi_0)}{2} \quad (7)$$

where:

ϕ_0 = phase adjustment from slot 0 of the first frame.

7.2.3 Mode 1 operation during compressed mode

7.2.3.1 Downlink in compressed mode and uplink in normal mode

When downlink is in compressed mode but uplink is operating normally (i.e. not compressed) the UTRAN continues it's Tx diversity related functions in the same way as in non-compressed downlink mode.

In downlink transmission gaps there are uplink slots for which no new estimate of the phase adjustment is calculated. During these slots the following rules are applied in UE when determining the feedback command:

1) If no new estimate of phase adjustment ϕ_i exists corresponding to the feedback command to be sent in uplink slot i:

- If $1 < i < 15$:
  - the feedback command sent in uplink slot i-2 is used;
- else if $i = 0$:
  - the feedback command sent in uplink slot 14 of previous frame is used;
- else if $i = 1$:
  - the feedback command sent in uplink slot 13 of previous frame is used;
- end if.

2) When transmission in downlink is started again in downlink slot N_{last}+1 (if N_{last}+1 = 15, then slot 0 in the next frame) the UE must resume calculating new estimates of the phase adjustment. The feedback command corresponding to the first new estimate of ϕ_i must be sent in the uplink slot which is transmitted approximately 1024 chips in offset from the downlink slot N_{last}+1.

7.2.3.2 Both downlink and uplink in compressed mode

During the uplink transmission gaps no FB commands are sent from UE to UTRAN. When transmission in downlink is started again in downlink slot N_{last}+1 (if N_{last}+1 = 15, then slot 0 in the next frame) the UE must resume calculating new estimates of the phase adjustment. The feedback command corresponding to the first new estimate of ϕ_i must be sent in the uplink slot which is transmitted approximately 1024 chips in offset from the downlink slot N_{last}+1.

The UTRAN continues to update the weight w_2 until the uplink transmission gap starts and no more FB commands are received. When the transmission in downlink resumes in slot N_{last}+1, the value of w_2, calculated after receiving the last FB command before the start of the uplink transmission gap, is applied to antenna 2 signal.

After the UE resumes transmission in uplink and sends the first FB command, the new value of w_2 is calculated as follows:

- S_1 = {0, 2, 4, 6, 8, 10, 12 14}.
- S_2 = {1, 3, 5, 7, 9, 11, 13}.
- i = number of uplink slot at which the transmission resumes.
- j = number of uplink slot at which the last FB command was sent before the start of the uplink transmission gap.
- Do while ($i \in S_1$ *and* $j \in S_1$) or ($i \in S_2$ *and* $j \in S_2$):
  - j = j-1;
  - if j < 0;
  - j = 14;
- end if;
- end do;
- calculate w_2 based on FB commands received in uplink slots i and j.

Note that for N_{last} = 13 the end of frame adjustment procedure shall be based on the FB commands for the last odd slot prior to the uplink transmission gap and slot 0.

7.2.3.3 Uplink in compressed mode and downlink in normal mode

The UTRAN continues to update the value of w_2 until the uplink transmission gap starts and no more FB commands are received. Then, the value of w_2 calculated after receiving the last FB command before the uplink transmission gap is applied to the antenna 2 signal. When the UE resumes transmission in uplink, it shall send FB commands according to section 7.2 equations 2 and 3 (normal operation) and the UTRAN Access Point shall interpret the FB commands according to Table 9.

The calculation of w_2 by the UTRAN following the uplink transmission gap, and before the first two FB commands following the gap are received is not specified.

7.2.4 Mode 1 initialisation during compressed mode

7.2.4.1 Downlink in compressed mode

When closed loop mode 1 is initialised during the downlink transmission gap of compressed mode there are slots for which no estimate of the phase adjustment is calculated and no previous feedback command is available.

In this case, if the UE is required to send feedback in the uplink, the FB command to the UTRAN shall be '0'.

When transmission in downlink is started again in slot $N_{last}+1$ (if $N_{last}+1 = 15$, then slot 0 in the next frame), the UTRAN shall use the initial weight $w_2 = \frac{1}{2}(1+j)$. The UE must start calculating estimates of the phase adjustment.

The feedback command corresponding to the first estimate of ϕ_i must be sent in the uplink slot which is transmitted approximately 1024 chips in offset from the downlink slot $N_{last}+1$. Having received this feedback command the UTRAN calculates w_2 as follows:

$$w_2 = \frac{\cos(\phi_i) + \cos(\phi_j)}{2} + j\frac{\sin(\phi_i) + \sin(\phi_j)}{2} \quad (8)$$

where:

ϕ_i = phase adjustment in uplink slot i , which is transmitted approximately 1024 chips in offset from the downlink slot $N_{last}+1$.

$\phi_j = \frac{\pi}{2}$, if slot i is even ($i \in \{0, 2, 4, 6, 8, 10, 12, 14\}$) and

$\phi_j = 0$, if slot i is odd ($i \in \{1, 3, 5, 7, 9, 11, 13\}$)

7.2.4.2 Uplink in compressed mode

Initialisation of closed loop mode 1 operation during uplink compressed mode only is not specified.

7.3 Closed loop mode 2

In closed loop mode 2 there are 16 possible combinations of phase and power adjustment from which the UE selects and transmits the FSM according to table 10 and table 11. As opposed to closed loop Mode 1, no constellation rotation is done at UE and no filtering of the received weights is performed at the UTRAN.

Table 10: FSM_{po} subfield of closed loop mode 2 signalling message

FSM_{po}	Power_ant1	Power_ant2
0	0.2	0.8
1	0.8	0.2

Table 11: FSM_{ph} subfield of closed loop mode 2 signalling message

FSM_{ph}	Phase difference between antennas (radians)
000	π
001	$-3\pi/4$
011	$-\pi/2$
010	$-\pi/4$
110	0
111	$\pi/4$
101	$\pi/2$
100	$3\pi/4$

To obtain the best performance, progressive updating is performed at both the UE and the UTRAN Access point. The UE procedure shown below is an example of how to determine FSM at UE. Different implementation is allowed. Every slot time, the UE may refine its choice of FSM, from the set of weights allowed given the previously transmitted bits of the FSM. This is shown in figure 5, where, in this figure b_i ($0 \le i \le 3$) are the bits of the FSM (from table 10 and table 11) from the MSB to the LSB and m=0, 1, 2, 3 (the end of frame adjustment given in subclause 7.3.1 is not shown here).

At the beginning of a FSM to be transmitted, the UE chooses the best FSM out of the 16 possibilities. Then the UE starts sending the FSM bits from the MSB to the LSB in the portion of FBI field of the uplink DPCCH during 4 (FSM message length) slots. Within the transmission of the FSM the UE refines its choice of FSM. This is defined in the following:

- define the 4 bits of FSM, which are transmitted from slot number k to k+3, as $\{b_3(k)\ b_2(k+1)\ b_1(k+2)\ b_0(k+3)\}$, where k=0, 4, 8, 12. Define also the estimated received power criteria defined in Equation 1 for a given FSM as $P(\{x_3, x_2\ x_1\ x_0\})$, where $\{ x_3\ x_2\ x_1\ x_0 \}$ is one of the 16 possible FSMs which defines an applied phase and power offset according to table 10 and table 11. The $b_i()$ and x_i are 0 or 1.

The bits transmitted during the m'th FSM of the frame, where m=0,1,2,3, are then given by:

$b_3(4m)=X_3$ from the $\{X_3\ X_2\ X_1\ X_0\}$ which maximises $P(\{x_3\ x_2\ x_1\ x_0\})$ over all x_3,x_2,x_1,x_0 (16 possible combinations);

$b_2(4m+1)=X_2$ from the $\{b_3(4m)\ X_2\ X_1\ X_0\}$ which maximises $P(\{b_3(4m)\ x_2\ x_1\ x_0\})$ over all x_2,x_1,x_0 (8 possible combinations);

$b_1(4m+2)=X_1$ from the $\{b_3(4m)\ b_2(4m+1)\ X_1\ X_0\}$ which maximises $P(\{b_3(4m)\ b_2(4m+1)\ x_1\ x_0\})$ over all x_1,x_0 (4 possible combinations);

$b_0(4m+3)=X_0$ from the $\{b_3(4m)\ b_2(4m+1)\ b_1(4m+2)\ X_0\}$ which maximises $P(\{b_3(4m)\ b_2(4m+1)\ b_1(4m+2)\ x_0\})$ over x_0 (2 possible combinations).

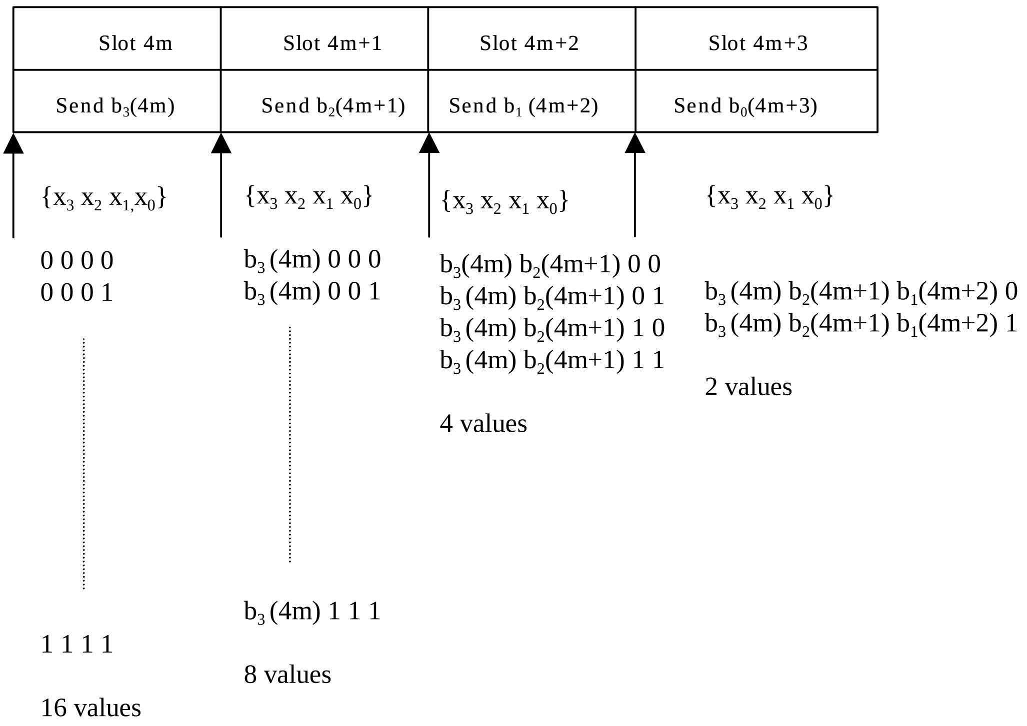

Figure 5: Progressive Refinement at the UE for closed loop mode 2

Every slot time the UTRAN constructs the FSM from the most recently received bits for each position in the word and applies the phase and amplitude (derived from power) as defined by table 10 and table 11. More precisely, the UTRAN operation can be explained as follows. The UTRAN maintains a register **z**=$\{z_3\ z_2\ z_1\ z_0\}$, which is updated every slot time according to $z_i=b_i(ns)$ (i=0:3, ns=0:14). Every slot time the contents of register **z** are used to determine the phase and power adjustments as defined by table 10 and table 11, with $FSM_{ph}=\{z_3\ z_2\ z_1\}$ and $FSM_{po}=z_0$.

Special procedures for initialisation and end of frame processing are described below.

The weight vector, $\underline{w}$, is then calculated as:

$$\underline{w} = \begin{bmatrix} \sqrt{power\_ant1} \\ \sqrt{power\_ant2}\,\exp(j\ phase\_diff) \end{bmatrix} \quad (9)$$

7.3.1 Mode 2 end of frame adjustment

The FSM must be wholly contained within a frame. To achieve this an adjustment is made to the last FSM in the frame where the UE only sends the FSM_{ph} subfield, and the UTRAN takes the power bit FSM_{po} of the previous FSM.

7.3.2 Mode 2 normal initialisation

For the first frame of transmission using closed loop mode 2, the operation is as follows.

The UE starts sending the FSM message from slot 0 in the normal way. The UE may refine its choice of FSM in slots 1 to 3 from the set of weights allowed given the previously transmitted bits of the FSM.

The UTRAN Access Point operation is as follows. Until the first FSM_{po} bit is received and acted upon (depending on the timing control specified via the higher layer parameter described in section 7.1) the power in both antennas shall be set to 0.5. Until the first FSM_{ph} bit is received and acted upon the phase difference between antennas shall be π radians.

The phase offset applied between the antennas is updated according to the number and value of FSM_{ph} bits received as given in table 12.

Table 12: FSM_{ph} normal initialisation for closed loop mode 2

FSM_{ph}	Phase difference between antennas (radians)
- - -	π (normal initialisation) or held from previous setting (compressed mode recovery)
0 - -	π
1 - -	0
0 0 -	π
0 1 -	-π/2
1 1 -	0
1 0 -	π/2
0 0 0	π
0 0 1	-3π/4
0 1 1	-π/2
0 1 0	-π/4
1 1 0	0
1 1 1	π/4
1 0 1	π/2
1 0 0	3π/4

This operation applies in both the soft handover and non soft handover cases.

7.3.3 Mode 2 operation during compressed mode

7.3.3.1 Downlink in compressed mode and uplink in normal mode

When the downlink is in compressed mode and the uplink is in normal mode, the closed loop mode 2 functions are described below.

When the UE is not listening to the CPICH from antennas 1 and 2 during the downlink transmission gap, the UE sends the last FSM bits calculated before the start of the downlink transmission gap.

Recovery from compressed mode is described in the following. Downlink transmissions commence at the pilot field of slot Nlast as described in [2].

After a transmission gap, UTRAN Access Point sets the power in both antennas to 0.5 until a FSM_{po} bit is received and acted upon. Until the first FSM_{ph} bit is received and acted upon, UTRAN uses the phase offset, which was applied before the transmission interruption (table 12).

If the uplink slot Nlast+1 (modulo 15) occurs at the beginning of a FSM period (that is at slot 0,4,8,or 12), the UE sends the FSM message in the normal way, with 3 FSM_{ph} bits and with the FSM_{po} bit on slot 3, 7 or 11, and the UTRAN Access Point acts on the FSM_{ph} bits according to table 12.

If the uplink slot Nlast+1 (modulo 15) does not occur at the beginning of a FSM period, the following operation is performed. In each of the remaining slots of the partial FSM period, that is from slot Nlast+1 (modulo 15) until the final slot (slot 3, 7, 11or 14), and for the first slot of the next full FSM period, the UE sends the first (i.e. MSB) bit of the FSM_{ph} message, and at the UTRAN access point the phase offset applied between the antennas is updated according to the number and value of FSM_{ph} bits received as given in table 13. During the following full FSM period, which starts on slot 0, 4, 8, or 12, the UE sends the FSM message in the normal way, with 3 FSM_{ph} bits and with the FSM_{po} bit on slot 3, 7 or 11, and the UTRAN Access Point acts on the FSM_{ph} bits according to table 12.

Table 13: FSM_{ph} subfield of closed loop mode 2 in compressed mode recovery period

FSM_{ph}	Phase difference between antennas (radians)
-	held from previous setting
0	π
1	0

7.3.3.2 Both downlink and uplink in compressed mode

During both downlink and uplink compressed mode, the UTRAN and the UE performs the functions of recovery after transmission gaps as described in the previous subclause 7.3.3.1.

7.3.3.3 Uplink in compressed mode and downlink in normal mode

The UTRAN continues to update the weight vector *w* until the uplink transmission gap starts and no more FSM bits are received. Then, UTRAN Access Point continues to apply the weight vector *w*, which was used before the transmission gap. When the UE resumes transmission in uplink, it chooses FSM according to normal operation as described in section 7.3 and 7.3.1. If the uplink signalling does not resume at the beginning of a FSM period, the UE shall calculate the remaining FSM bits according to section 7.3, using the last FSM(s) sent before the uplink gap as the "previously transmitted bits of the FSM".

The calculation of the phase adjustment by UTRAN remains unspecified until all 3 FSM_{ph} bits have been received following the uplink transmission gap. The calculation of the power adjustment by UTRAN remains unspecified until an FSM_{po} bit has been received following the uplink transmission gap.

7.3.4 Mode 2 initialisation during compressed mode

7.3.4.1 Downlink in compressed mode

When closed loop mode 2 is initialised during the downlink transmission gap of compressed mode there are slots for which no FSM bit is calculated and no previous sent FSM bit is available.

In this case, if the UE is required to send feedback in the uplink, the FB command to the UTRAN shall be '0'.

The UTRAN and the UE perform the functions of recovery after the downlink transmission gap as described in the previous subclause 7.3.3.1. If no previous phase setting is available, UTRAN shall use the phase offset π, until the first FSM_{ph} bit is received and acted upon.

7.3.4.2 Uplink in compressed mode

Initialisation of closed loop mode 2 operation during uplink compressed mode only is not specified.

3GPP TSG RAN Meeting #14
Kyoto, Japan, 11th-14th, December, 2001

R1-01-1122

CR-Form-v4

CHANGE REQUEST

⌘	**25.214 CR 210**	⌘ rev	**-**	⌘ Current version:	**3.8.0**	⌘

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

Title: ⌘	Downlink phase reference reconfiguration		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	TEI	***Date:*** ⌘	2001-11-13
Category: ⌘	**F**	***Release:*** ⌘	R99
	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: ⌘	Two cases of downlink phase reference reconfiguration that may require specified UE and UTRAN behaviour with respect to radio link synchronisation have been identified: a) Reconfiguration of an existing radio link from using P-CPICH as downlink phase reference to using dedicated pilots b) Reconfiguration of an existing radio link from using S-CPICH as downlink phase reference to using dedicated pilots
Summary of change: ⌘	Add that for existing radio links the downlink phase reference from P-CPICH or S-CPICH to dedicated pilots is not supported.
Consequences if not approved: ⌘	Risk of losing downlink synchronisation if one of the reconfigurations should be performed for an existing radio link.

Clauses affected: ⌘	4.3.2.1	
Other specs Affected: ⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments: ⌘	This CR is considered to have isolated impact.	

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change reques

4.3.2 Radio link establishment and physical layer reconfiguration for dedicated channels

4.3.2.1 General

Two synchronisation procedures are defined in order to obtain physical layer synchronisation of dedicated channels between UE and UTRAN:

- Synchronisation procedure A : This procedure shall be used when at least one downlink dedicated physical channel and one uplink dedicated physical channel are to be set up on a frequency and none of the radio links after the establishment/reconfiguration existed prior to the establishment/reconfiguration which also includes the following cases :
    - the UE was previously on another RAT i.e. inter-RAT handover
    - the UE was previously on another frequency i.e. inter-frequency hard handover
    - the UE has all its previous radio links removed and replaced by other radio links i.e. intra-frequency hard-handover
- Synchronisation procedure B : This procedure shall be used when one or several radio links are added to the active set and at least one of the radio links prior to the establishment/reconfiguration still exists after the establishment/reconfiguration.

For existing radio links, the reconfiguration of downlink phase reference from P-CPICH or S-CPICH to dedicated pilots is not supported. For all other physical layer reconfigurations not listed above, the UE and UTRAN shall not perform any of the synchronisation procedures listed above.

The two synchronisation procedures are described in subclauses 4.3.2.3 and 4.3.2.4 respectively.

4.3.2.2 Node B radio link set state machine

In Node B, each radio link set can be in three different states: initial state, out-of-sync state and in-sync state. Transitions between the different states is shown in figure 1 below. The state of the Node B at the start of radio link establishment is described in the following subclauses. Transitions between initial state and in-sync state are described in subclauses 4.3.2.3 and 4.3.2.4 and transitions between the in-sync and out-of-sync states are described in subclause 4.3.3.2.

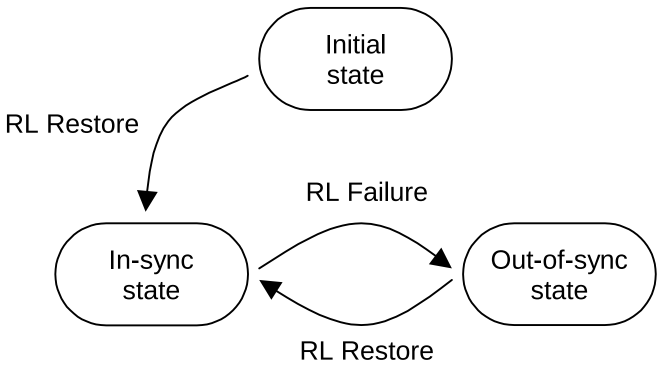

Figure 1: Node B radio link set states and transitions

4.3.2.3 Synchronisation procedure A

The synchronisation establishment procedure, which begins at the time indicated by higher layers (either immediately at receipt of upper layer signalling, or at an indicated activation time), is as follows:

a) Each Node B involved in the procedure sets all the radio link sets which are to be set-up for this UE in the initial state.

b) UTRAN shall start the transmission of the downlink DPCCH and may start the transmission of DPDCH if any data is to be transmitted. The initial downlink DPCCH transmit power is set by higher layers [6]. Downlink TPC commands are generated as described in 5.1.2.2.1.2.

c) The UE establishes downlink chip and frame synchronisation of DPCCH, using the P-CCPCH timing and timing offset information notified from UTRAN. Frame synchronisation can be confirmed using the frame synchronisation word. Downlink synchronisation status is reported to higher layers every radio frame according to subclause 4.3.1.2.

d) The UE shall not transmit on uplink until higher layers consider the downlink physical channel established. If no activation time for uplink DPCCH has been signalled to the UE, uplink DPCCH transmission shall start when higher layers consider the downlink physical channel established. If an activation time has been given, uplink DPCCH transmission shall not start before the downlink physical channel has been established and the activation time has been reached. Physical channel establishment and activation time are defined in [5]. The initial uplink DPCCH transmit power is set by higher layers [5]. In case of physical layer reconfiguration the uplink DPCCH power is kept unchanged between before and after the reconfiguration except for inner loop power control adjustments. A power control preamble shall be applied as indicated by higher layers. The transmission of the uplink DPCCH power control preamble shall start N_{pcp} radio frames prior to the start of uplink DPDCH transmission, where N_{pcp} is a higher layer parameter set by UTRAN [5]. Note that the transmission start delay between DPCCH and DPDCH may be cancelled using a power control preamble of 0 length. The starting time for transmission of DPDCHs shall also satisfy the constraints on adding transport channels to a CCTrCH, as defined in [2] sub-clause 4.2.14, independently of whether there are any bits mapped to the DPDCHs. During the uplink DPCCH power control preamble, independently of the selected TFC, no transmission is done on the DPDCH.

e) UTRAN establishes uplink chip and frame synchronisation. Frame synchronisation can be confirmed using the frame synchronisation word. Radio link sets remain in the initial state until N_INSYNC_IND successive in-sync indications are received from layer 1, when Node B shall trigger the RL Restore procedure indicating which radio link set has obtained synchronisation. When RL Restore has been triggered the radio link set shall be considered to be in the in-sync state. The parameter value of N_INSYNC_IND is configurable, see [6]. The RL Restore procedure may be triggered several times, indicating when synchronisation is obtained for different radio link sets.

Note: The total signalling response delay for the establishment of a new DPCH shall not exceed the requirements given in [5] sub-clause 13.5.

4.3.2.4 Synchronisation procedure B

The synchronisation procedure B, which begins at the time indicated by higher layers (either immediately at receipt of upper layer signalling, or at an indicated activation time) is as follows:

a) The following applies to each Node B involved in the procedure:

  - New radio link sets are set up to be in initial state.

  - If one or several radio links are added to an existing radio link set, this radio link set shall be considered to be in the state the radio link set was prior to the addition of the radio link, i.e. if the radio link set was in the in-sync state before the addition of the radio link it shall remain in that state.

b) UTRAN starts the transmission of the downlink DPCCH/DPDCH for each new radio link at a frame timing such that the frame timing received at the UE will be within $T_0 \pm 148$ chips prior to the frame timing of the uplink DPCCH/DPDCH at the UE. Simultaneously, UTRAN establishes uplink chip and frame synchronisation of each new radio link. Frame synchronisation can be confirmed using the frame synchronization word. Radio link sets considered to be in the initial state shall remain in the initial state until N_INSYNC_IND successive in-sync indications are received from layer 1, when Node B shall trigger the RL Restore procedure indicating which radio link set has obtained synchronisation. When RL Restore is triggered the radio link set shall be considered to be in the in-sync state. The parameter value of N_INSYNC_IND is configurable, see [6]. The RL Restore procedure may be triggered several times, indicating when synchronisation is obtained for different radio link sets.

c) The UE establishes chip and frame synchronisation of each new radio link. Layer 1 in the UE keeps reporting downlink synchronisation status to higher layers every radio frame according to the second phase of sub-clause 4.3.1.2. Frame synchronisation can be confirmed using the frame synchronization word.

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CHANGE REQUEST

⌘	**25.214 CR 211**	⌘ rev	**-**	⌘ Current version:	**4.2.0**	⌘

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- Synchronisation procedure B : This procedure shall be used when one or several radio links are added to the active set and at least one of the radio links prior to the establishment/reconfiguration still exists after the establishment/reconfiguration.

For existing radio links, the reconfiguration of downlink phase reference from P-CPICH or S-CPICH to dedicated pilots is not supported. For all other physical layer reconfigurations not listed above, the UE and UTRAN shall not perform any of the synchronisation procedures listed above.

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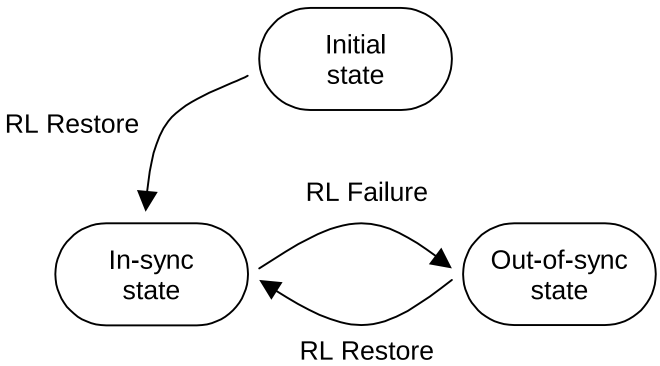

Figure 1: Node B radio link set states and transitions

4.3.2.3 Synchronisation procedure A

The synchronisation establishment procedure, which begins at the time indicated by higher layers (either immediately at receipt of upper layer signalling, or at an indicated activation time), is as follows:

a) Each Node B involved in the procedure sets all the radio link sets which are to be set-up for this UE in the initial state.

b) UTRAN shall start the transmission of the downlink DPCCH and may start the transmission of DPDCH if any data is to be transmitted. The initial downlink DPCCH transmit power is set by higher layers [6]. Downlink TPC commands are generated as described in 5.1.2.2.1.2.

c) The UE establishes downlink chip and frame synchronisation of DPCCH, using the P-CCPCH timing and timing offset information notified from UTRAN. Frame synchronisation can be confirmed using the frame synchronisation word. Downlink synchronisation status is reported to higher layers every radio frame according to subclause 4.3.1.2.

d) The UE shall not transmit on uplink until higher layers consider the downlink physical channel established. If no activation time for uplink DPCCH has been signalled to the UE, uplink DPCCH transmission shall start when higher layers consider the downlink physical channel established. If an activation time has been given, uplink DPCCH transmission shall not start before the downlink physical channel has been established and the activation time has been reached. Physical channel establishment and activation time are defined in [5]. The initial uplink DPCCH transmit power is set by higher layers [5]. In case of physical layer reconfiguration the uplink DPCCH power is kept unchanged between before and after the reconfiguration except for inner loop power control adjustments. A power control preamble shall be applied as indicated by higher layers. The transmission of the uplink DPCCH power control preamble shall start N_{pcp} radio frames prior to the start of uplink DPDCH transmission, where N_{pcp} is a higher layer parameter set by UTRAN [5]. Note that the transmission start delay between DPCCH and DPDCH may be cancelled using a power control preamble of 0 length. The starting time for transmission of DPDCHs shall also satisfy the constraints on adding transport channels to a CCTrCH, as defined in [2] sub-clause 4.2.14, independently of whether there are any bits mapped to the DPDCHs. During the uplink DPCCH power control preamble, independently of the selected TFC, no transmission is done on the DPDCH.

e) UTRAN establishes uplink chip and frame synchronisation. Frame synchronisation can be confirmed using the frame synchronisation word. Radio link sets remain in the initial state until N_INSYNC_IND successive in-sync indications are received from layer 1, when Node B shall trigger the RL Restore procedure indicating which radio link set has obtained synchronisation. When RL Restore has been triggered the radio link set shall be considered to be in the in-sync state. The parameter value of N_INSYNC_IND is configurable, see [6]. The RL Restore procedure may be triggered several times, indicating when synchronisation is obtained for different radio link sets.

Note: The total signalling response delay for the establishment of a new DPCH shall not exceed the requirements given in [5] sub-clause 13.5.

4.3.2.4 Synchronisation procedure B

The synchronisation procedure B, which begins at the time indicated by higher layers (either immediately at receipt of upper layer signalling, or at an indicated activation time) is as follows:

a) The following applies to each Node B involved in the procedure:

- New radio link sets are set up to be in initial state.
- If one or several radio links are added to an existing radio link set, this radio link set shall be considered to be in the state the radio link set was prior to the addition of the radio link, i.e. if the radio link set was in the in-sync state before the addition of the radio link it shall remain in that state.

b) UTRAN starts the transmission of the downlink DPCCH/DPDCH for each new radio link at a frame timing such that the frame timing received at the UE will be within $T_0 \pm 148$ chips prior to the frame timing of the uplink DPCCH/DPDCH at the UE. Simultaneously, UTRAN establishes uplink chip and frame synchronisation of each new radio link. Frame synchronisation can be confirmed using the frame synchronization word. Radio link sets considered to be in the initial state shall remain in the initial state until N_INSYNC_IND successive in-sync indications are received from layer 1, when Node B shall trigger the RL Restore procedure indicating which radio link set has obtained synchronisation. When RL Restore is triggered the radio link set shall be considered to be in the in-sync state. The parameter value of N_INSYNC_IND is configurable, see [6]. The RL Restore procedure may be triggered several times, indicating when synchronisation is obtained for different radio link sets.

c) The UE establishes chip and frame synchronisation of each new radio link. Layer 1 in the UE keeps reporting downlink synchronisation status to higher layers every radio frame according to the second phase of sub-clause 4.3.1.2. Frame synchronisation can be confirmed using the frame synchronization word.

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CR-Form-v5

CHANGE REQUEST

⌘	**25.214**	**CR**	**218**	⌘ **rev**	**1**	⌘	Current version:	**3.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

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

Title:	⌘ Downlink power control for channels supporting CPCH		
Source:	⌘ TSG RAN WG1		
Work item code:	⌘ TEI	***Date:*** ⌘	Nov 14th
Category:	⌘ **F**	***Release:*** ⌘	R99
	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: ⌘	Power control for dl channels supporting CPCH (DL-DPCCH for CPCH, AP-AICH, CD/CA-ICH is not described. Only the uplink power control for the CPCH is described as part of the CPCH access procedure. The detection requirement for the indicator channels (AP-AICH, CD/CA/ICH) for the UE were already included in Rel-5 of 25.101 in line with the AICH detection requirement. The power levels for these indicators are missing from the RRC, but present in the NBAP. There is hence an inconsistency between the specifications. The power levels should be introduced in 25.214 and 25.331 in a consistent manner. As power control for the DL-DPCCH for CPCH is not described it is not fully clear that the CPCH may not be combined with DPC_MODE neither SSDT. It is not fully clear either how many offsets there are on the different field for the DL-DPCCH for CPCH nor how the offsets are defined. As the power of the CCC field is equal to the pilot only one offset is needed, as there is no TFCI bit. This clarification is needed in order to correct also the number of offsets and their meaning in 25.433, which currently defines 3 offsets as for the dedicated channels.
Summary of change: ⌘	A section is added to describe the downlink power control for the Dl-DPCCH for CPCH. The power offsets between the different fields (TPC, CCC and pilot) are clarified. Furthermore an example for the inner loop power control for the DL-DPCCH is added in alignment with power control for the DPCCH/DPDCH when applicable (power control in normal mode and no SSDT). As the DL-DPCCH for CPCH is not in soft handover, the Node B behaviour is described as an example rather than mandatory. Other sections are added in order to align the power setting procedure for the AP-AICH and CD/CA-ICH to that of the AICH. In that case the node B behaviour is mandatory as it impacts the UE detecting capability.

		Isolated impact analysis This is an isolated impact CR that corrects a functionality (CPCH) where the specification was incomplete and in contradiction with other specifications. This CR would not affect other features but CPCH.
Consequences if not approved:	⌘	Detection problem for the indicators supporting CPCH. Possible mis-understanding regarding the incompatibility between CPCH and DPC-MODE and SSDT.

Clauses affected:	⌘	5.2			
Other specs affected:	⌘		Other core specifications	⌘	25.331, 25.433
			Test specifications		
			O&M Specifications		
Other comments:	⌘				

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSGmeetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.1 DPCCH/DPDCH

5.2.1.1 General

The downlink transmit power control procedure controls simultaneously the power of a DPCCH and its corresponding DPDCHs. The power control loop adjusts the power of the DPCCH and DPDCHs with the same amount, i.e. the relative power difference between the DPCCH and DPDCHs is not changed.

The relative transmit power offset between DPCCH fields and DPDCHs is determined by the network The TFCI, TPC and pilot fields of the DPCCH are offset relative to the DPDCHs power by PO1, PO2 and PO3 dB respectively. The power offsets may vary in time. The method for controlling the power offsets within UTRAN is specified in [6]

~~The power of CCC field in DL DPCCH for CPCH is the same as the power of the pilot field.~~

5.2.1.2 Ordinary transmit power control

5.2.1.2.1 UE behaviour

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH. An example on how to derive the TPC commands in given in Annex B.2.

The UE shall check the downlink power control mode (DPC_MODE) before generating the TPC command:

- if DPC_MODE = 0 : the UE sends a unique TPC command in each slot and the TPC command generated is transmitted in the first available TPC field in the uplink DPCCH;
- if DPC_MODE = 1 : the UE repeats the same TPC command over 3 slots and the new TPC command is transmitted such that there is a new command at the beginning of the frame.

The DPC_MODE parameter is a UE specific parameter controlled by the UTRAN.

The UE shall not make any assumptions on how the downlink power is set by UTRAN, in order to not prohibit usage of other UTRAN power control algorithms than what is defined in subclause 5.2.1.2.2.

5.2.1.2.2 UTRAN behaviour

Upon receiving the TPC commands UTRAN shall adjust its downlink DPCCH/DPDCH power accordingly. For DPC_MODE = 0, UTRAN shall estimate the transmitted TPC command TPC_{est} to be 0 or 1, and shall update the power every slot. If DPC_MODE = 1, UTRAN shall estimate the transmitted TPC command TPC_{est} over three slots to be 0 or 1, and shall update the power every three slots.

After estimating the *k*:th TPC command, UTRAN shall adjust the current downlink power $P(k-1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$P(k) = P(k - 1) + P_{TPC}(k) + P_{bal}(k)$,

where $P_{TPC}(k)$ is the *k*:th power adjustment due to the inner loop power control, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in [6].

$P_{TPC}(k)$ is calculated according to the following.

If the value of *Limited Power Increase Used* parameter is 'Not used', then

$$\mathrm{P_{TPC}}(k) = \begin{cases} +\Delta_{\mathrm{TPC}} & \text{if } \mathrm{TPC_{est}}(k) = 1 \\ -\Delta_{\mathrm{TPC}} & \text{if } \mathrm{TPC_{est}}(k) = 0 \end{cases}, \text{ [dB]}. \qquad (1)$$

If the value of *Limited Power Increase Used* parameter is 'Used', then the *k*:th inner loop power adjustment shall be calculated as:

$$P_{TPC}(k)=\begin{cases}+\Delta_{TPC} & \text{if } \mathrm{TPC_{est}}(k)=1 \text{ and } \Delta_{sum}(k)+\Delta_{TPC}<\text{Power\_Raise\_Limit}\\ 0 & \text{if } \mathrm{TPC_{est}}(k)=1 \text{ and } \Delta_{sum}(k)+\Delta_{TPC}\geq\text{Power\_Raise\_Limit}\\ -\Delta_{TPC} & \text{if } \mathrm{TPC_{est}}(k)=0\end{cases}, \text{[dB]} \quad (2)$$

where

$$\Delta_{sum}(k)=\sum_{i=k-\text{DL\_Power\_Averaging\_Window\_Size}}^{k-1} P_{TPC}(i)$$

is the temporary sum of the last *DL_Power_Averaging_Window_Size* inner loop power adjustments (in dB).

For the first (*DL_Power_Averaging_Window_Size* – 1) adjustments after the activation of the limited power increase method, formula (1) shall be used instead of formula (2). *Power_Raise_Limit* and *DL_Power_Averaging_Window_Size* are parameters configured in the UTRAN.

The power control step size Δ_{TPC} can take four values: 0.5, 1, 1.5 or 2 dB. It is mandatory for UTRAN to support Δ_{TPC} of 1 dB, while support of other step sizes is optional.

In addition to the above described formulas on how the downlink power is updated, the restrictions below apply.

In case of congestion (commanded power not available), UTRAN may disregard the TPC commands from the UE.

The average power of transmitted DPDCH symbols over one timeslot shall not exceed Maximum_DL_Power (dB), nor shall it be below Minimum_DL_Power (dB). Transmitted DPDCH symbol means here a complex QPSK symbol before spreading which does not contain DTX. Maximum_DL_Power (dB) and Minimum_DL_Power (dB) are power limits for one channelisation code, relative to the primary CPICH power [6].

5.2.1.3 Power control in compressed mode

The aim of downlink power control in uplink or/and downlink compressed mode is to recover as fast as possible a signal-to-interference ratio (SIR) close to the target SIR after each transmission gap.

The UE behaviour is the same in compressed mode as in normal mode, described in subclause 5.2.1.2, except that the target SIR is offset by higher layer signalling.

In compressed mode, compressed frames may occur in either the uplink or the downlink or both. In compressed frames, the transmission of downlink DPDCH(s) and DPCCH shall be stopped during transmission gaps.

The power of the DPCCH and DPDCH in the first slot after the transmission gap should be set to the same value as in the slot just before the transmission gap.

In every slot during compressed mode except during downlink transmission gaps, UTRAN shall estimate the *k*:th TPC command and adjust the current downlink power $P(k-1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$P(k) = P(k - 1) + P_{TPC}(k) + P_{SIR}(k) + P_{bal}(k)$,

where $P_{TPC}(k)$ is the *k*:th power adjustment due to the inner loop power control, $P_{SIR}(k)$ is the k-th power adjustment due to the downlink target SIR variation, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in [6].

Due to transmission gaps in uplink compressed frames, there may be missing TPC commands in the uplink. If no uplink TPC command is received, $P_{TPC}(k)$ derived by the Node B shall be set to zero. Otherwise, $P_{TPC}(k)$ is calculated the same way as in normal mode (see sub-clause 5.2.1.2.2) but with a step size Δ_{STEP} instead of Δ_{TPC}.

The power control step size $\Delta_{STEP} = \Delta_{RP-TPC}$ during RPL slots after each transmission gap and $\Delta_{STEP} = \Delta_{TPC}$ otherwise, where:

- RPL is the recovery period length and is expressed as a number of slots. RPL is equal to the minimum value out of the transmission gap length and 7 slots. If a transmission gap is scheduled to start before RPL slots have elapsed, then the recovery period shall end at the start of the gap, and the value of RPL shall be reduced accordingly.

– Δ_{RP-TPC} is called the recovery power control step size and is expressed in dB. Δ_{RP-TPC} is equal to the minimum value of 3 dB and $2\Delta_{TPC}$.

The power offset $P_{SIR}(k) = \delta P_{curr} - \delta P_{prev}$, where δP_{curr} and δP_{prev} are respectively the value of δP in the current slot and the most recently transmitted slot and δP is computed as follows:

$$\delta P = \max(\Delta P1\_compression, \ldots, \Delta Pn\_compression) + \Delta P1\_coding + \Delta P2\_coding$$

where n is the number of different TTI lengths amongst TTIs of all TrChs of the CCTrCh, where ΔP1_coding and ΔP2_coding are computed from uplink parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1, DeltaSIRafter2 signaled by higher layers as:

- ΔP1_coding = DeltaSIR1 if the start of the first transmission gap in the transmission gap pattern is within the current frame.
- ΔP1coding = DeltaSIRafter1 if the current frame just follows a frame containing the start of the first transmission gap in the transmission gap pattern.
- ΔP2_coding = DeltaSIR2 if the start of the second transmission gap in the transmission gap pattern is within the current frame.
- ΔP2_coding = DeltaSIRafter2 if the current frame just follows a frame containing the start of the second transmission gap in the transmission gap pattern.
- ΔP1_coding = 0 dB and ΔP2_coding = 0 dB in all other cases.

and ΔPi_compression is defined by :

- ΔPi_compression = 3 dB for downlink frames compressed by reducing the spreading factor by 2.
- ΔPi_compression = $10 \log (15*F_i / (15*F_i - TGL_i))$ if there is a transmission gap created by puncturing method within the current TTI of length F_i frames, where TGL_i is the gap length in number of slots (either from one gap or a sum of gaps) in the current TTI of length F_i frames.
- ΔPi_compression = 0 dB in all other cases.

In case several compressed mode patterns are used simultaneously, a δP offset is computed for each compressed mode pattern and the sum of all δP offsets is applied to the frame.

For all time slots except those in transmissions gaps, the average power of transmitted DPDCH symbols over one timeslot shall not exceed Maximum_DL_Power (dB) by more than P_{SIR}, nor shall it be below Minimum_DL_Power (dB). Transmitted DPDCH symbol means here a complex QPSK symbol before spreading which does not contain DTX. Maximum_DL_Power (dB) and Minimum_DL_Power (dB) are power limits for one channelisation code, relative to the primary CPICH power [6].

5.2.1.4 Site selection diversity transmit power control

5.2.1.4.1 General

Site selection diversity transmit power control (SSDT) is another macro diversity method in soft handover mode. This method is optional in UTRAN.

Operation is summarised as follows. The UE selects one of the cells from its active set to be ‘primary’, all other cells are classed as ‘non primary’. The main objective is to transmit on the downlink from the primary cell, thus reducing the interference caused by multiple transmissions in a soft handover mode. A second objective is to achieve fast site selection without network intervention, thus maintaining the advantage of the soft handover. In order to select a primary cell, each cell is assigned a temporary identification (ID) and UE periodically informs a primary cell ID to the connecting cells. The non-primary cells selected by UE switch off the transmission power. The primary cell ID is delivered by UE to the active cells via uplink FBI field. SSDT activation, SSDT termination and ID assignment are all carried out by higher layer signalling.

SSDT can only be used when the P-CPICH is used as the downlink phase reference.

5.2.1.4.1.1 Definition of temporary cell identification

Each cell is given a temporary ID during SSDT and the ID is utilised as site selection signal. The ID is given a binary bit sequence. There are three different lengths of coded ID available denoted as "long", "medium" and "short". The network decides which length of coded ID is used. Settings of ID codes for 1-bit and 2-bit FBI are exhibited in table 3 and table 4, respectively.

Table 3: Settings of ID codes for 1 bit FBI

ID label	ID code "long"	"medium"	"short"
a	000000000000000	(0)0000000	00000
b	101010101010101	(0)1010101	01001
c	011001100110011	(0)0110011	11011
d	110011001100110	(0)1100110	10010
e	000111100001111	(0)0001111	00111
f	101101001011010	(0)1011010	01110
g	011110000111100	(0)0111100	11100
h	110100101101001	(0)1101001	10101

Table 4: Settings of ID codes for 2 bit FBI

ID label	ID code (Column and Row denote slot position and FBI-bit position.) "long"	"medium"	"short"
a	(0)0000000 (0)0000000	(0)000 (0)000	000 000
b	(0)0000000 (1)1111111	(0)000 (1)111	000 111
c	(0)1010101 (0)1010101	(0)101 (0)101	101 101
d	(0)1010101 (1)0101010	(0)101 (1)010	101 010
e	(0)0110011 (0)0110011	(0)011 (0)011	011 011
f	(0)0110011 (1)1001100	(0)011 (1)100	011 100
g	(0)1100110 (0)1100110	(0)110 (0)110	110 110
h	(0)1100110 (1)0011001	(0)110 (1)001	110 001

The ID code bits shown in table 3 and table 4 are transmitted from left to right. In table 4, the first row gives the first FBI bit in each slot, the second row gives the 2nd FBI bit in each slot. The ID code(s) are transmitted aligned to the radio frame structure (i.e. ID codes shall be terminated within a frame). If FBI space for sending the last ID code within a frame cannot be obtained, the first bit(s) from that ID code are punctured. The bit(s) to be punctured are shown in brackets in table 3 and table 4.

The alignment of the ID codes to the radio frame structure is not affected by transmission gaps resulting from uplink compressed mode.

5.2.1.4.2 TPC procedure in UE

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH based on the downlink signals from the primary cell only. An example on how to derive the TPC commands is given in Annex B.2.

5.2.1.4.3 Selection of primary cell

The UE selects a primary cell periodically by measuring the RSCP of P-CPICHs transmitted by the active cells. The cell with the highest P-CPICH RSCP is detected as a primary cell.

5.2.1.4.4 Delivery of primary cell ID

The UE periodically sends the ID code of the primary cell via portion of the uplink FBI field assigned for SSDT use (FBI S field). A cell recognises its state as non-primary if the following conditions are fulfilled simultaneously:

- The received ID code does not match with the own ID code.
- The received uplink signal quality satisfies a quality threshold, Qth, a parameter defined by the network.
- If uplink compressed mode is used, and less than $\lfloor N_{ID}/3 \rfloor$ bits are lost from the ID code (as a result of uplink compressed mode), where N_{ID} is the number of bits in the ID code (after puncturing according to clause 5.2.1.4.1.1, if puncturing has been done).

Otherwise the cell recognises its state as primary.

The state of the cells (primary or non-primary) in the active set is updated synchronously. If a cell receives the last portion of the coded ID in uplink slot j, the state of cell is updated in downlink slot $(j+1+T_{os})$ mod 15, where T_{os} is defined as a constant of 2 time slots. The updating of the cell state is not influenced by the operation of downlink compressed mode.

At the UE, the primary ID code to be sent to the cells is segmented into a number of portions. These portions are distributed in the uplink FBI S-field. The cell in SSDT collects the distributed portions of the primary ID code and then detects the transmitted ID. The period of the primary cell update depends on the settings of the code length and the number of FBI bits assigned for SSDT use as shown in table 5.

Table 5: Period of primary cell update

	The number of FBI bits per slot assigned for SSDT	
code length	1	2
"long"	1 update per frame	2 updates per frame
"medium"	2 updates per frame	4 updates per frame
"short"	3 updates per frame	5 updates per frame

5.2.1.4.5 TPC procedure in the network

In SSDT, a non-primary cell can switch off its DPDCH output (i.e. no transmissions).

The cell manages two downlink transmission power levels, P1, and P2. Power level P1 is used for downlink DPCCH transmission power level and this level is updated in the same way with the downlink DPCCH power adjustment specified in 5.2.1.2.2 (for normal mode) and 5.2.1.3 (for compressed mode) regardless of the selected state (primary or non-primary). The actual transmission power of TFCI, TPC and pilot fields of DPCCH is set by adding P1 and the offsets PO1, PO2 and PO3, respectively, as specified in 5.2.1.1. P2 is used for downlink DPDCH transmission power level and this level is set to P1 if the cell is selected as primary, otherwise P2 is switched off. The cell updates P1 first and P2 next, and then the two power settings P1 and P2 are maintained within the power control dynamic range. Table 6 summarizes the updating method of P1 and P2.

Table 6: Updating of P1 and P2

State of cell	P1 (DPCCH)	P2 (DPDCH)
non primary	Updated in the same way with the downlink DPCCH power adjustment specified in 5.2.1.2.2 and 5.2.1.3	Switched off
primary		= P1

5.2.2 PDSCH

The PDSCH power control can be based on the following solutions, which are selectable, by the network:

- Inner-loop power control based on the power control commands sent by the UE on the uplink DPCCH.
- Slow power control.

5.2.3 DL-DPCCH for CPCH

5.2.3.1 UE behaviour

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH. The UE shall send a unique TPC command in each slot as in the DPCCH/DPDCH case for DPC_MODE=0.

The TPC commands setting may be based on the example provided in Annex B.2 for the DPCCH/DPDCH. However in the DL-DPCCH for CPCH case, the setting of the SIR_target by the outer loop power control is based on a DL-DPCCH for CPCH BER target provided by the UTRAN rather than a TrCH BLER. Also there is no soft handover, neither SSDT, used in combination with the CPCH.

The UE shall not make any assumptions on how the downlink power is set by UTRAN, in order to not prohibit usage of other UTRAN power control algorithms than what is defined in sub-clause 5.2.1.2.2.

5.2.3.2 UTRAN behaviour

The relative transmit power offsets between the different DPCCH fields (TPC and pilot) and CCC field is determined by the network. The power of CCC field in DL DPCCH for CPCH is the same as the power of the pilot field.

The TPC field of the DPCCH is offset relative to the pilot by PO2dB. This power offsets may vary in time. The method for controlling the power offset within UTRAN is specified in [6]

The UTRAN behaviour for the power control is left open to the implementation. As an example it may be based on the UTRAN behaviour for the DPCCH/DPDCH as specified in sub-clause 5.2.1.2.2, with the following exceptions : DPC_MODE should be set to 0 as there is no DPC_MODE parameter for CPCH and there is no support of Site selection diversity power control for the DL-DPCCH for CPCH as Soft handover is not applicable to the CPCH.

5.2.4~~3~~ AICH

The UE is informed about the relative transmit power of the AICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.5~~4~~ PICH

The UE is informed about the relative transmit power of the PICH (measured as the power over the paging indicators) compared to the primary CPICH transmit power by the higher layers.

5.2.6~~5~~ S-CCPCH

The TFCI and pilot fields may be offset relative to the power of the data field. The power offsets may vary in time.

5.2.7~~6~~ CSICH

The UE is informed about the relative transmit power of the CSICH (measured as the power per transmitted status indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.8 AP-AICH

The UE is informed about the relative transmit power of the AP-AICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.9 CA/CD-ICH

The UE is informed about the relative transmit power of the CA/CD-ICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

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CHANGE REQUEST

⌘	**25.214**	**CR**	**219**	⌘ **rev**	**1**	⌘ Current version:	**4.2.0** ⌘

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

Title:	⌘ Downlink power control for channels supporting CPCH			
Source:	⌘ TSG RAN WG1			
Work item code:	⌘ TEI		***Date:*** ⌘	Nov 14th
Category:	⌘ **A** *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.		***Release:*** ⌘	REL-4 *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: ⌘	Power control for dl channels supporting CPCH (DL-DPCCH for CPCH, AP-AICH, CD/CA-ICH is not described. Only the uplink power control for the CPCH is described as part of the CPCH access procedure. The detection requirement for the indicator channels (AP-AICH, CD/CA/ICH) for the UE were already included in Rel-5 of 25.101 in line with the AICH detection requirement. The power levels for these indicators are missing from the RRC, but present in the NBAP. There is hence an inconsistency between the specifications. The power levels should be introduced in 25.214 and 25.331 in a consistent manner. As power control for the DL-DPCCH for CPCH is not described it is not fully clear that the downlink power control for DL-DPCCH for CPCH may not rely on a DPC_MODE parameter neither on SSDT. It is not fully clear either how many offsets there are on the different field for the DL-DPCCH for CPCH nor how the offsets are defined. As the power of the CCC field is equal to the pilot only one offset is needed, as there is no TFCI bit. This clarification is needed in order to correct also the number of offsets and their meaning in 25.433, which currently defines 3 offsets as for the dedicated channels.
Summary of change: ⌘	A section is added to describe the downlink power control for the Dl-DPCCH for CPCH. The power offsets between the different fields (TPC, CCC and pilot) are clarified. Furthermore an example for the inner loop power control for the DL-DPCCH is added in alignment with power control for the DPCCH/DPDCH when applicable (power control in normal mode and no SSDT). As the DL-DPCCH for CPCH is not in soft handover, the Node B behaviour is described as an example rather than mandatory. Other sections are added in order to align the power setting procedure for the AP-AICH and CD/CA-ICH to that of the AICH. In that case the node B behaviour is mandatory as it impacts the UE detecting capability.

		Isolated impact analysis This is an isolated impact CR that corrects a functionality (CPCH) where the specification was incomplete and in contradiction with other specifications. This CR would not affect other features but CPCH.
Consequences if not approved:	⌘	Detection problem for the indicators supporting CPCH. Possible mis-understanding regarding the incompatibility between CPCH and DPC-MODE and SSDT.

Clauses affected:	⌘	5.2			
Other specs affected:	⌘	☐	Other core specifications	⌘	25.331, 25.433
		☐	Test specifications		
		☐	O&M Specifications		
Other comments:	⌘				

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSGmeetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2 Downlink power control

The transmit power of the downlink channels is determined by the network. In general the ratio of the transmit power between different downlink channels is not specified and may change with time. However, regulations exist as described in the following subclauses.

Higher layer power settings shall be interpreted as setting of the total power, i.e. the sum of the power from the two antennas in case of transmit diversity.

5.2.1 DPCCH/DPDCH

5.2.1.1 General

The downlink transmit power control procedure controls simultaneously the power of a DPCCH and its corresponding DPDCHs. The power control loop adjusts the power of the DPCCH and DPDCHs with the same amount, i.e. the relative power difference between the DPCCH and DPDCHs is not changed.

The relative transmit power offset between DPCCH fields and DPDCHs is determined by the network The TFCI, TPC and pilot fields of the DPCCH are offset relative to the DPDCHs power by PO1, PO2 and PO3 dB respectively. The power offsets may vary in time. The method for controlling the power offsets within UTRAN is specified in [6]

~~The power of CCC field in DL DPCCH for CPCH is the same as the power of the pilot field.~~

5.2.1.2 Ordinary transmit power control

5.2.1.2.1 UE behaviour

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH. An example on how to derive the TPC commands in given in Annex B.2.

The UE shall check the downlink power control mode (DPC_MODE) before generating the TPC command:

- if DPC_MODE = 0 : the UE sends a unique TPC command in each slot and the TPC command generated is transmitted in the first available TPC field in the uplink DPCCH;
- if DPC_MODE = 1 : the UE repeats the same TPC command over 3 slots and the new TPC command is transmitted such that there is a new command at the beginning of the frame.

The DPC_MODE parameter is a UE specific parameter controlled by the UTRAN.

The UE shall not make any assumptions on how the downlink power is set by UTRAN, in order to not prohibit usage of other UTRAN power control algorithms than what is defined in subclause 5.2.1.2.2.

5.2.1.2.2 UTRAN behaviour

Upon receiving the TPC commands UTRAN shall adjust its downlink DPCCH/DPDCH power accordingly. For DPC_MODE = 0, UTRAN shall estimate the transmitted TPC command TPC_{est} to be 0 or 1, and shall update the power every slot. If DPC_MODE = 1, UTRAN shall estimate the transmitted TPC command TPC_{est} over three slots to be 0 or 1, and shall update the power every three slots.

After estimating the k:th TPC command, UTRAN shall adjust the current downlink power $P(k\text{-}1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$$P(k) = P(k - 1) + P_{TPC}(k) + P_{bal}(k),$$

where $P_{TPC}(k)$ is the k:th power adjustment due to the inner loop power control, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in [6].

$P_{TPC}(k)$ is calculated according to the following.

If the value of *Limited Power Increase Used* parameter is 'Not used', then

$$P_{TPC}(k) = \begin{cases} +\Delta_{TPC} & \text{if } TPC_{est}(k) = 1 \\ -\Delta_{TPC} & \text{if } TPC_{est}(k) = 0 \end{cases}, \text{ [dB]}. \quad (1)$$

If the value of *Limited Power Increase Used* parameter is 'Used', then the *k:*th inner loop power adjustment shall be calculated as:

$$P_{TPC}(k) = \begin{cases} +\Delta_{TPC} & \text{if } TPC_{est}(k) = 1 \text{ and } \Delta_{sum}(k) + \Delta_{TPC} < \text{Power\_Raise\_Limit} \\ 0 & \text{if } TPC_{est}(k) = 1 \text{ and } \Delta_{sum}(k) + \Delta_{TPC} \geq \text{Power\_Raise\_Limit} \\ -\Delta_{TPC} & \text{if } TPC_{est}(k) = 0 \end{cases}, \text{ [dB]} \quad (2)$$

where

$$\Delta_{sum}(k) = \sum_{i=k-\text{DL\_Power\_Averaging\_Window\_Size}}^{k-1} P_{TPC}(i)$$

is the temporary sum of the last *DL_Power_Averaging_Window_Size* inner loop power adjustments (in dB).

For the first (*DL_Power_Averaging_Window_Size* – 1) adjustments after the activation of the limited power increase method, formula (1) shall be used instead of formula (2). *Power_Raise_Limit* and *DL_Power_Averaging_Window_Size* are parameters configured in the UTRAN.

The power control step size Δ_{TPC} can take four values: 0.5, 1, 1.5 or 2 dB. It is mandatory for UTRAN to support Δ_{TPC} of 1 dB, while support of other step sizes is optional.

In addition to the above described formulas on how the downlink power is updated, the restrictions below apply.

In case of congestion (commanded power not available), UTRAN may disregard the TPC commands from the UE.

The average power of transmitted DPDCH symbols over one timeslot shall not exceed Maximum_DL_Power (dB), nor shall it be below Minimum_DL_Power (dB). Transmitted DPDCH symbol means here a complex QPSK symbol before spreading which does not contain DTX. Maximum_DL_Power (dB) and Minimum_DL_Power (dB) are power limits for one channelisation code, relative to the primary CPICH power [6].

5.2.1.3 Power control in compressed mode

The aim of downlink power control in uplink or/and downlink compressed mode is to recover as fast as possible a signal-to-interference ratio (SIR) close to the target SIR after each transmission gap.

The UE behaviour is the same in compressed mode as in normal mode, described in subclause 5.2.1.2, except that the target SIR is offset by higher layer signalling.

In compressed mode, compressed frames may occur in either the uplink or the downlink or both. In compressed frames, the transmission of downlink DPDCH(s) and DPCCH shall be stopped during transmission gaps.

The power of the DPCCH and DPDCH in the first slot after the transmission gap should be set to the same value as in the slot just before the transmission gap.

In every slot during compressed mode except during downlink transmission gaps, UTRAN shall estimate the *k*:th TPC command and adjust the current downlink power $P(k-1)$ [dB] to a new power $P(k)$ [dB] according to the following formula:

$P(k) = P(k - 1) + P_{TPC}(k) + P_{SIR}(k) + P_{bal}(k)$,

where $P_{TPC}(k)$ is the *k*:th power adjustment due to the inner loop power control, $P_{SIR}(k)$ is the k-th power adjustment due to the downlink target SIR variation, and $P_{bal}(k)$ [dB] is a correction according to the downlink power control procedure for balancing radio link powers towards a common reference power. The power balancing procedure and control of the procedure is described in [6].

Due to transmission gaps in uplink compressed frames, there may be missing TPC commands in the uplink. If no uplink TPC command is received, $P_{TPC}(k)$ derived by the Node B shall be set to zero. Otherwise, $P_{TPC}(k)$ is calculated the same way as in normal mode (see sub-clause 5.2.1.2.2) but with a step size Δ_{STEP} instead of Δ_{TPC}.

The power control step size $\Delta_{STEP} = \Delta_{RP\text{-}TPC}$ during RPL slots after each transmission gap and $\Delta_{STEP} = \Delta_{TPC}$ otherwise, where:

- RPL is the recovery period length and is expressed as a number of slots. RPL is equal to the minimum value out of the transmission gap length and 7 slots. If a transmission gap is scheduled to start before RPL slots have elapsed, then the recovery period shall end at the start of the gap, and the value of RPL shall be reduced accordingly.

- $\Delta_{RP\text{-}TPC}$ is called the recovery power control step size and is expressed in dB. $\Delta_{RP\text{-}TPC}$ is equal to the minimum value of 3 dB and $2\Delta_{TPC}$.

The power offset $P_{SIR}(k) = \delta P_{curr} - \delta P_{prev}$, where δP_{curr} and δP_{prev} are respectively the value of δP in the current slot and the most recently transmitted slot and δP is computed as follows:

$$\delta P = \max(\Delta P1\_compression, \ldots, \Delta Pn\_compression) + \Delta P1\_coding + \Delta P2\_coding$$

where n is the number of different TTI lengths amongst TTIs of all TrChs of the CCTrCh, where ΔP1_coding and ΔP2_coding are computed from uplink parameters DeltaSIR1, DeltaSIR2, DeltaSIRafter1, DeltaSIRafter2 signaled by higher layers as:

- ΔP1_coding = DeltaSIR1 if the start of the first transmission gap in the transmission gap pattern is within the current frame.

- ΔP1coding = DeltaSIRafter1 if the current frame just follows a frame containing the start of the first transmission gap in the transmission gap pattern.

- ΔP2_coding = DeltaSIR2 if the start of the second transmission gap in the transmission gap pattern is within the current frame.

- ΔP2_coding = DeltaSIRafter2 if the current frame just follows a frame containing the start of the second transmission gap in the transmission gap pattern.

- ΔP1_coding = 0 dB and ΔP2_coding = 0 dB in all other cases.

and ΔPi_compression is defined by :

- ΔPi_compression = 3 dB for downlink frames compressed by reducing the spreading factor by 2.

- ΔPi_compression = $10 \log (15 * F_i / (15 * F_i - TGL_i))$ if there is a transmission gap created by puncturing method within the current TTI of length F_i frames, where TGL_i is the gap length in number of slots (either from one gap or a sum of gaps) in the current TTI of length F_i frames.

- ΔPi_compression = 0 dB in all other cases.

In case several compressed mode patterns are used simultaneously, a δP offset is computed for each compressed mode pattern and the sum of all δP offsets is applied to the frame.

For all time slots except those in transmissions gaps, the average power of transmitted DPDCH symbols over one timeslot shall not exceed Maximum_DL_Power (dB) by more than P_{SIR}, nor shall it be below Minimum_DL_Power (dB). Transmitted DPDCH symbol means here a complex QPSK symbol before spreading which does not contain DTX. Maximum_DL_Power (dB) and Minimum_DL_Power (dB) are power limits for one channelisation code, relative to the primary CPICH power [6].

5.2.1.4 Site selection diversity transmit power control

5.2.1.4.1 General

Site selection diversity transmit power control (SSDT) is another macro diversity method in soft handover mode. This method is optional in UTRAN.

Operation is summarised as follows. The UE selects one of the cells from its active set to be 'primary', all other cells are classed as 'non primary'. The main objective is to transmit on the downlink from the primary cell, thus reducing the interference caused by multiple transmissions in a soft handover mode. A second objective is to achieve fast site selection without network intervention, thus maintaining the advantage of the soft handover. In order to select a primary cell, each cell is assigned a temporary identification (ID) and UE periodically informs a primary cell ID to the connecting cells. The non-primary cells selected by UE switch off the transmission power. The primary cell ID is delivered by UE to the active cells via uplink FBI field. SSDT activation, SSDT termination and ID assignment are all carried out by higher layer signalling.

SSDT can only be used when the P-CPICH is used as the downlink phase reference.

UTRAN may also command UE to use SSDT signalling in the uplink although cells would transmit the downlink as without SSDT active. In case SSDT is used in the uplink direction only, the processing in the UE for the radio links received in the downlink is as with macro diversity in non-SSDT case. The downlink operation mode for SSDT is set by higher layers. UTRAN may use the SSDT information for the PDSCH power control as specified in section 5.2.2.

NOTE: This feature of SSDT limited to uplink only applies to terminals that are DSCH capable.

5.2.1.4.1.1 Definition of temporary cell identification

Each cell is given a temporary ID during SSDT and the ID is utilised as site selection signal. The ID is given a binary bit sequence. There are three different lengths of coded ID available denoted as "long", "medium" and "short". The network decides which length of coded ID is used. Settings of ID codes for 1-bit and 2-bit FBI are exhibited in table 3 and table 4, respectively.

Table 3: Settings of ID codes for 1 bit FBI

ID label	ID code "long"	ID code "medium"	ID code "short"
a	000000000000000	(0)0000000	00000
b	101010101010101	(0)1010101	01001
c	011001100110011	(0)0110011	11011
d	110011001100110	(0)1100110	10010
e	000111100001111	(0)0001111	00111
f	101101001011010	(0)1011010	01110
g	011110000111100	(0)0111100	11100
h	110100101101001	(0)1101001	10101

Table 4: Settings of ID codes for 2 bit FBI

ID label	ID code (Column and Row denote slot position and FBI-bit position.) "long"	"medium"	"short"
a	(0)0000000 (0)0000000	(0)000 (0)000	000 000
b	(0)0000000 (1)1111111	(0)000 (1)111	000 111
c	(0)1010101 (0)1010101	(0)101 (0)101	101 101
d	(0)1010101 (1)0101010	(0)101 (1)010	101 010
e	(0)0110011 (0)0110011	(0)011 (0)011	011 011
f	(0)0110011 (1)1001100	(0)011 (1)100	011 100
g	(0)1100110 (0)1100110	(0)110 (0)110	110 110
h	(0)1100110 (1)0011001	(0)110 (1)001	110 001

The ID code bits shown in table 3 and table 4 are transmitted from left to right. In table 4, the first row gives the first FBI bit in each slot, the second row gives the 2nd FBI bit in each slot. The ID code(s) are transmitted aligned to the radio frame structure (i.e. ID codes shall be terminated within a frame). If FBI space for sending the last ID code within a frame cannot be obtained, the first bit(s) from that ID code are punctured. The bit(s) to be punctured are shown in brackets in table 3 and table 4.

The alignment of the ID codes to the radio frame structure is not affected by transmission gaps resulting from uplink compressed mode.

5.2.1.4.2 TPC procedure in UE

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH based on the downlink signals from the primary cell only. An example on how to derive the TPC commands is given in Annex B.2.

5.2.1.4.3 Selection of primary cell

The UE selects a primary cell periodically by measuring the RSCP of P-CPICHs transmitted by the active cells. The cell with the highest P-CPICH RSCP is detected as a primary cell.

5.2.1.4.4 Delivery of primary cell ID

The UE periodically sends the ID code of the primary cell via portion of the uplink FBI field assigned for SSDT use (FBI S field). A cell recognises its state as non-primary if the following conditions are fulfilled simultaneously:

- The received ID code does not match with the own ID code.
- The received uplink signal quality satisfies a quality threshold, Qth, a parameter defined by the network.
- If uplink compressed mode is used, and less than $\lfloor N_{ID}/3 \rfloor$ bits are lost from the ID code (as a result of uplink compressed mode), where N_{ID} is the number of bits in the ID code (after puncturing according to clause 5.2.1.4.1.1, if puncturing has been done).

Otherwise the cell recognises its state as primary.

The state of the cells (primary or non-primary) in the active set is updated synchronously. If a cell receives the last portion of the coded ID in uplink slot j, the state of cell is updated in downlink slot $(j+1+T_{os})$ mod 15, where T_{os} is defined as a constant of 2 time slots. The updating of the cell state is not influenced by the operation of downlink compressed mode.

At the UE, the primary ID code to be sent to the cells is segmented into a number of portions. These portions are distributed in the uplink FBI S-field. The cell in SSDT collects the distributed portions of the primary ID code and then detects the transmitted ID. The period of the primary cell update depends on the settings of the code length and the number of FBI bits assigned for SSDT use as shown in table 5.

Table 5: Period of primary cell update

code length	The number of FBI bits per slot assigned for SSDT: 1	2
"long"	1 update per frame	2 updates per frame
"medium"	2 updates per frame	4 updates per frame
"short"	3 updates per frame	5 updates per frame

5.2.1.4.5 TPC procedure in the network

In SSDT, a non-primary cell can switch off its DPDCH output (i.e. no transmissions).

The cell manages two downlink transmission power levels, P1, and P2. Power level P1 is used for downlink DPCCH transmission power level and this level is updated in the same way with the downlink DPCCH power adjustment specified in 5.2.1.2.2 (for normal mode) and 5.2.1.3 (for compressed mode) regardless of the selected state (primary or non-primary). The actual transmission power of TFCI, TPC and pilot fields of DPCCH is set by adding P1 and the offsets PO1, PO2 and PO3, respectively, as specified in 5.2.1.1. P2 is used for downlink DPDCH transmission power level and this level is set to P1 if the cell is selected as primary, otherwise P2 is switched off. The cell updates P1 first and P2 next, and then the two power settings P1 and P2 are maintained within the power control dynamic range. Table 6 summarizes the updating method of P1 and P2.

Table 6: Updating of P1 and P2

State of cell	P1 (DPCCH)	P2 (DPDCH)
non primary	Updated in the same way with the downlink DPCCH power adjustment specified in 5.2.1.2.2 and 5.2.1.3	Switched off
primary		= P1

5.2.2 PDSCH

The PDSCH power control can be based on the following solutions, which are selectable, by the network:

- Inner-loop power control based on the power control commands sent by the UE on the uplink DPCCH.
- Slow power control.

UTRAN may use the SSDT signalling to determine what power offset to use for PDSCH with respect to the associated downlink DCH when more than one cell may be in the active set.

The PDSCH power offset to be used with respect to the associated DCH depends on whether the cell transmitting PDSCH is determined to be a primary one or not.

The SSDT commands sent by the UE are averaged in UTRAN side over one or more frames. The averaging window length parameter as the number of frames to average over, *SSDT_aveg_window*, and the parameter for the required number of received primary SSDT commands, *SSDT_primary_commands*, during the averaging window for declaring primary status for a cell are given by UTRAN.

If the number of primary ID codes in the uplink received during the averaging window is less than the parameter *SSDT_primary_commands*, then a cell shall consider itself as non-primary and uses the power offset given from UTRAN to the cell with the data for the PDSCH.

If the number of primary ID codes in the uplink received during the averaging window is equal or more than the parameter *SSDT_primary_commands* defines, the cell shall use the power control parameterisation for the primary case. When the cell considers itself as primary it uses both the power offset for the PDSCH frame for the given UE and the *Enhanced DSCH Power Offset* parameter given by the UTRAN for the primary case.

5.2.3 DL-DPCCH for CPCH

5.2.3.1 UE behaviour

The UE shall generate TPC commands to control the network transmit power and send them in the TPC field of the uplink DPCCH. The UE shall send a unique TPC command in each slot as in the DPCCH/DPDCH case for DPC_MODE=0.

The TPC commands setting may be based on the example provided in Annex B.2 for the DPCCH/DPDCH. However in the DL-DPCCH for CPCH case, the setting of the SIR_target by the outer loop power control is based on a DL-DPCCH for CPCH BER target provided by the UTRAN rather than a TrCH BLER. Also there is no soft handover, neither SSDT, used in combination with the CPCH.

The UE shall not make any assumptions on how the downlink power is set by UTRAN, in order to not prohibit usage of other UTRAN power control algorithms than what is defined in sub-clause 5.2.1.2.2.

5.2.3.2 UTRAN behaviour

The relative transmit power offsets between the different DPCCH fields (TPC and pilot) and CCC field is determined by the network. The power of CCC field in DL DPCCH for CPCH is the same as the power of the pilot field.

The TPC field of the DPCCH is offset relative to the pilot by PO2dB. This power offsets may vary in time. The method for controlling the power offset within UTRAN is specified in [6]

The UTRAN behaviour for the power control is left open to the implementation. As an example it may be based on the UTRAN behaviour for the DPCCH/DPDCH as specified in sub-clause 5.2.1.2.2, with the following exceptions : DPC_MODE should be set to 0 as there is no DPC_MODE parameter for CPCH and there is no support of Site selection diversity power control for the DL-DPCCH for CPCH as Soft handover is not applicable to the CPCH.

5.2.43 AICH

The UE is informed about the relative transmit power of the AICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.54 PICH

The UE is informed about the relative transmit power of the PICH (measured as the power over the paging indicators) compared to the primary CPICH transmit power by the higher layers.

5.2.65 S-CCPCH

The TFCI and pilot fields may be offset relative to the power of the data field. The power offsets may vary in time.

5.2.76 CSICH

The UE is informed about the relative transmit power of the CSICH (measured as the power per transmitted status indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.8 AP-AICH

The UE is informed about the relative transmit power of the AP-AICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

5.2.9 CA/CD-ICH

The UE is informed about the relative transmit power of the CA/CD-ICH (measured as the power per transmitted acquisition indicator) compared to the primary CPICH transmit power by the higher layers.

3GPP TSG RAN Meeting #14
Kyoto, Japan, 11th-14th, December, 2001

R1-01-1245

CR-Form-v4

CHANGE REQUEST

⌘	**25.214**	**CR**	**222**	⌘ rev	**-**	⌘	Current version:	**3.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

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

Title:	⌘ Removal of Slow Power Control from TS 25.214		
Source:	⌘ TSG RAN WG1		
Work item code:	⌘ TEI	***Date:*** ⌘	21 November 2001
Category:	⌘ **F**	***Release:*** ⌘	R99
	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: ⌘	The 'slow power control' procedure for the PDSCH is not defined in the current releases of the TSG RAN specifications.
Summary of change: ⌘	Remove the 'slow power control' citations from TS 25.214. **Isolated impact analysis:** This is an isolated impact change. Would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.
Consequences if not approved: ⌘	The current releases of the TSG RAN specifications will include an incomplete feature.

Clauses affected: ⌘	5.2.2	
Other specs affected: ⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments: ⌘		

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.2 PDSCH

The PDSCH power control can be based on any of the following solutions, which are selectable, by the network:

- Inner-loop power control based on the power control commands sent by the UE on the uplink DPCCH.
- SlowOther power control procedures applied by the network.

3GPP TSG RAN Meeting #14
Kyoto, Japan, 11th-14th, December, 2001

R1-01-1245

CR-Form-v4

CHANGE REQUEST

⌘ **25.214 CR 223**	⌘ rev **-**	⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

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

Title: ⌘	Removal of Slow Power Control from TS 25.214		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘	TEI	***Date:*** ⌘	21 November 2001
Category: ⌘	**A**	***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: ⌘	The 'slow power control' procedure for the PDSCH is not defined in the current releases of the TSG RAN specifications.
Summary of change: ⌘	Remove the 'slow power control' citations from TS 25.214. **Isolated impact analysis:** This is an isolated impact change. Would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.
Consequences if not approved: ⌘	The current releases of the TSG RAN specifications will include an incomplete feature.

Clauses affected: ⌘	5.2.2	
Other specs affected: ⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	
Other comments: ⌘		

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.2.2 PDSCH

The PDSCH power control can be based on any of the following solutions, which are selectable, by the network:

- Inner-loop power control based on the power control commands sent by the UE on the uplink DPCCH.
- SlowOther power control procedures applied by the network.