TSG-RAN Working Group 1 meeting #19 **TSGR1#19(01)0278**
Las Vegas, NV, USA
February 27 – March 2, 2001

Agenda item: Release 99

Source: Ericsson

Title: Uplink power control preamble

Document for: Decision

Introduction

During last week's meeting, WG2 has agreed to increase the uplink DPCCH PCP length to 0..7 frames. In addition, a second parameter *SRB delay* was introduced that defines a further delay (0..7 frames) of certain signalling RBs, starting from the end of the PCP [R2-010585]. WG2 has informed WG1 in an LS about their conclusions.

TTI alignment of the uplink PCP

In their LS, WG2 is asking WG1 to consider alignment of the PCP with respect to the TTI.

In principle, the UE decides the point in time when it starts transmitting the PCP. Then, after expiration of the PCP, the transmission of DPDCH can start at the next CFN that fulfils the constrains on start timing of TrCHs given by section 4.2.14 of [2]. This means, that there would be an additional period of up to 7 frames, where no data can be transmitted. The UE behaviour during this period is not really specified yet.

As the SRB delay, that delays the TrCH carrying the signalling RB (e.g. for *handover complete* message), is defined to start from the end of the PCP, this delay could potentially end before any DPDCH transmission is possible or in general at a CFN that is not aligned with the TTI of this TrCH. When setting the SRB delay, it would be desirable to consider the TTI of the SRB. This however, could only be done in an efficient way if the start timing of the SRB delay would be TTI aligned with the CFN. This is currently not the case (as the PCP was so far defined as 0 or 1 frame).

A solution would be to define the PCP as the period of N_{PCP} frames of DPCCH transmission prior to the start of the DPDCH. As the start of the DPDCH is to be TTI aligned, the start of the SRB delay would also be TTI aligned and a reasonable setting of this parameter would be possible. Also, the possible period between end of PCP and beginning of DPDCH that is not clearly specified, would be omitted.

It should be noted that the potentially delayed start of the PCP would not increase the delay between CFN_N when the UE could start their DPCCH transmission and $CFN_{N+N\_PCP+(0..7)}$ where the DPDCH could start, as the DPDCH start follows from the PCP length, the TTIs of in DPDCH and CFN_N, irrespective whether the PCP is aligned with the DPDCH start or not.

Special TFCI

In earlier discussions in WG1, it was discussed which values should be sent in the TFCI fields to use during the period of PCP transmission. It was suggested to reserve a special TFCI 0. LS were sent on this issue to WG2 and WG3. WG2 has discussed the issue but saw no need to introduce such a special TFCI (which would cause a shifting in the CTFC mapping), as during the PCP it is not crucial that the TFCI matches the actual DPDCH transmission. However, there should be some clarification about this in the description of the uplink PCP.

Proposal

It is proposed to align the end of the uplink PCP (start of SRB delay) with the start of DPDCH transmission and to clarify that during uplink PCP no DPDCH transmission is done, independently of the selected TFC. Also, the description of PCP in 25.211 is somewhat improved.

CR-Form-v3

CHANGE REQUEST

TS 25.211	**CR 096**	rev **-**	Current version:	**3.5.0**

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

Title:	Uplink power control preamble		
Source:	Ericsson		
Work item code:		***Date:***	2001-02-23
Category:	**F**	***Release:***	R99

Use one of the following categories:
***F** (essential 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:	In 25.211 it is not at all described what a uplink power control preamble is.
Summary of change:	Add a very short description of the uplink PCP.
Consequences if not approved:	The description of uplink PCP would be incomplete.

Clauses affected:	5.2.1
Other specs affected:	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications
Other comments:	

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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 Dedicated uplink physical channels

There are two types of uplink dedicated physical channels, the uplink Dedicated Physical Data Channel (uplink DPDCH) and the uplink Dedicated Physical Control Channel (uplink DPCCH).

The DPDCH and the DPCCH are I/Q code multiplexed within each radio frame (see [4]).

The uplink DPDCH is used to carry the DCH transport channel. There may be zero, one, or several uplink DPDCHs on each radio link.

The uplink DPCCH is used to carry control information generated at Layer 1. The Layer 1 control information consists of known pilot bits to support channel estimation for coherent detection, transmit power-control (TPC) commands, feedback information (FBI), and an optional transport-format combination indicator (TFCI). The transport-format combination indicator informs the receiver about the instantaneous transport format combination of the transport channels mapped to the simultaneously transmitted uplink DPDCH radio frame. There is one and only one uplink DPCCH on each radio link.

Figure 1 shows the frame structure of the uplink dedicated physical channels. Each radio frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2560 chips, corresponding to one power-control period.

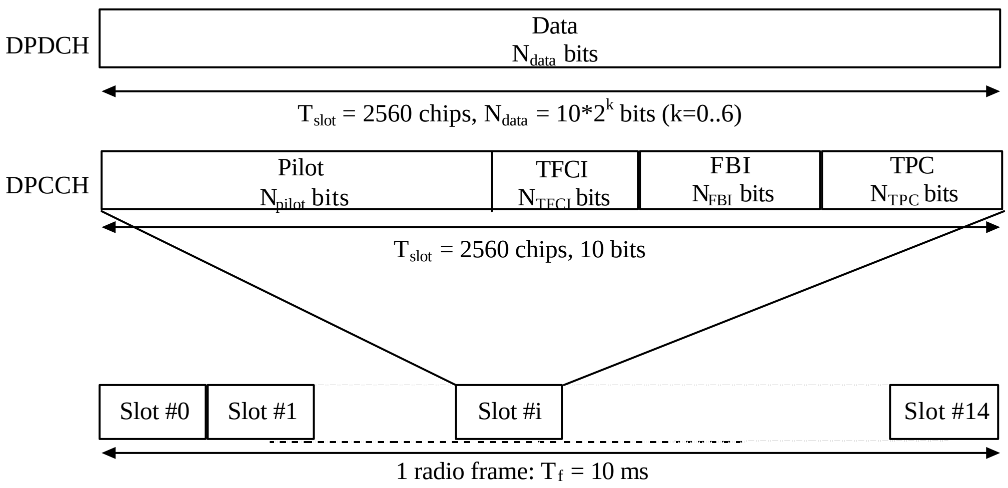

Figure 1: Frame structure for uplink DPDCH/DPCCH

The parameter k in figure 1 determines the number of bits per uplink DPDCH slot. It is related to the spreading factor SF of the DPDCH as SF = $256/2^k$. The DPDCH spreading factor may range from 256 down to 4. The spreading factor of the uplink DPCCH is always equal to 256, i.e. there are 10 bits per uplink DPCCH slot.

The exact number of bits of the uplink DPDCH and the different uplink DPCCH fields (N_{pilot}, N_{TFCI}, N_{FBI}, and N_{TPC}) is given by table 1 and table 2. What slot format to use is configured by higher layers and can also be reconfigured by higher layers.

The channel bit and symbol rates given in table 1 and table 2 are the rates immediately before spreading. The pilot patterns are given in table 3 and table 4, the TPC bit pattern is given in table 5.

The FBI bits are used to support techniques requiring feedback from the UE to the UTRAN Access Point, including closed loop mode transmit diversity and site selection diversity transmission (SSDT). The structure of the FBI field is shown in figure 2 and described below.

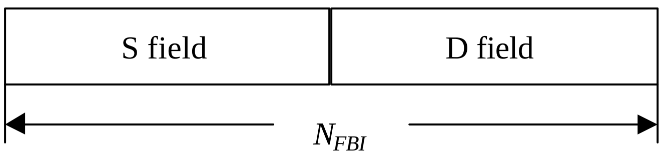

Figure 2: Details of FBI field

The S field is used for SSDT signalling, while the D field is used for closed loop mode transmit diversity signalling. The S field consists of 0, 1 or 2 bits. The D field consists of 0 or 1 bit. The total FBI field size N_{FBI} is given by table 2. If total FBI field is not filled with S field or D field, FBI field shall be filled with "1". When N_{FBI} is 2bits, S field is 0bit and D field is 1bit, left side field shall be filled with "1" and right side field shall be D field. Simultaneous use of SSDT power control and closed loop mode transmit diversity requires that the S field consists of 1 bit. The use of the FBI fields is described in detail in [5].

Table 1: DPDCH fields

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{data}
0	15	15	256	150	10	10
1	30	30	128	300	20	20
2	60	60	64	600	40	40
3	120	120	32	1200	80	80
4	240	240	16	2400	160	160
5	480	480	8	4800	320	320
6	960	960	4	9600	640	640

There are two types of uplink dedicated physical channels; those that include TFCI (e.g. for several simultaneous services) and those that do not include TFCI (e.g. for fixed-rate services). These types are reflected by the duplicated rows of table 2. It is the UTRAN that determines if a TFCI should be transmitted and it is mandatory for all UEs to support the use of TFCI in the uplink. The mapping of TFCI bits onto slots is described in [3].

In compressed mode, DPCCH slot formats with TFCI fields are changed. There are two possible compressed slot formats for each normal slot format. They are labelled A and B and the selection between them is dependent on the number of slots that are transmitted in each frame in compressed mode.

Table 2: DPCCH fields

Slot Form at #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Frame	Bits/ Slot	N_{pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
0	15	15	256	150	10	6	2	2	0	15
0A	15	15	256	150	10	5	2	3	0	10-14
0B	15	15	256	150	10	4	2	4	0	8-9
1	15	15	256	150	10	8	2	0	0	8-15
2	15	15	256	150	10	5	2	2	1	15
2A	15	15	256	150	10	4	2	3	1	10-14
2B	15	15	256	150	10	3	2	4	1	8-9
3	15	15	256	150	10	7	2	0	1	8-15
4	15	15	256	150	10	6	2	0	2	8-15
5	15	15	256	150	10	5	1	2	2	15
5A	15	15	256	150	10	4	1	3	2	10-14
5B	15	15	256	150	10	3	1	4	2	8-9

The pilot bit patterns are described in table 3 and table 4. The shadowed column part of pilot bit pattern is defined as FSW and FSWs can be used to confirm frame synchronization. (The value of the pilot bit pattern other than FSWs shall be "1".)

Table 3: Pilot bit patterns for uplink DPCCH with N_{pilot} = 3, 4, 5 and 6

	N_{pilot} = 3			N_{pilot} = 4				N_{pilot} = 5					N_{pilot} = 6					
Bit #	0	1	2	0	1	2	3	0	1	2	3	4	0	1	2	3	4	5
Slot #0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
1	0	0	1	1	0	0	1	0	0	1	1	0	1	0	0	1	1	0
2	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
3	0	0	1	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
4	1	0	1	1	1	0	1	1	0	1	0	1	1	1	0	1	0	1
5	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
6	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
7	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	1	0	0
8	0	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1
11	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0	1	1	1
12	1	0	1	1	1	0	1	1	0	1	0	0	1	1	0	1	0	0
13	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1
14	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1

Table 4: Pilot bit patterns for uplink DPCCH with N_{pilot} = 7 and 8

	N_{pilot} = 7							N_{pilot} = 8							
Bit #	0	1	2	3	4	5	6	0	1	2	3	4	5	6	7
Slot #0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
1	1	0	0	1	1	0	1	1	0	1	0	1	1	1	0
2	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1
3	1	0	0	1	0	0	1	1	0	1	0	1	0	1	0
4	1	1	0	1	0	1	1	1	1	1	0	1	0	1	1
5	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
6	1	1	1	1	0	0	1	1	1	1	1	1	0	1	0
7	1	1	0	1	0	0	1	1	1	1	0	1	0	1	0
8	1	0	1	1	1	0	1	1	0	1	1	1	1	1	0
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	0	1	1	0	1	1	1	0	1	1	1	0	1	1
11	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1
12	1	1	0	1	0	0	1	1	1	1	0	1	0	1	0
13	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1
14	1	0	0	1	1	1	1	1	0	1	0	1	1	1	1

The relationship between the TPC bit pattern and transmitter power control command is presented in table 5.

Table 5: TPC Bit Pattern

TPC Bit Pattern		Transmitter power control command
N_{TPC} = 1	N_{TPC} = 2	
1	11	1
0	00	0

Multi-code operation is possible for the uplink dedicated physical channels. When multi-code transmission is used, several parallel DPDCH are transmitted using different channelization codes, see [4]. However, there is only one DPCCH per radio link.

A period of uplink DPCCH transmission prior to the start of the uplink DPDCH transmission (uplink DPCCH power control preamble) shall be used for initialisation of a DCH. The length of the power control preamble is a higher layer parameter, N_{pcp} , signalled by the network [5]. The UL DPCCH shall take the same slot format in the power control preamble as afterwards, as given in table 2. When $N_{pcp} > 0$ the pilot patterns of table 3 and table 4 shall be used. The timing of the power control preamble is described in [5], subclause 4.3.2.2. The TFCI field is filled with "0" bits.

3GPP TSG-RAN WG1 Meeting #19 ***Tdoc R1(01)0278***
Las Vegas, NV, USA, February 27 – March 2, 2001

CR-Form-v3

CHANGE REQUEST

✍	**TS 25.214**	**CR**	**154**	✍ rev	**-**	✍ Current version:	**3.5.0** ✍

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

Title:	✍	Uplink power control preamble		
Source:	✍	Ericsson		
Work item code:	✍		***Date:*** ✍	2001-02-23
Category:	✍	**F**	***Release:*** ✍	R99

Use one of the following categories:
F *(essential correction)*
A *(corresponds to a correction in an earlier release)*
B *(Addition of feature),*
C *(Functional modification of feature)*
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Detailed explanations of the above categories can be found in 3GPP TR 21.900.

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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:	✍	UE behaviour between the end of the PCP and the actual start of DPDCH transmission (which is bound to certain CFNs) is not specified. RAN1 has been asked by RAN2 to clarify this. Also, the relation between selected TFC and no DPDCH transmission during the PCP is ambiguous.
Summary of change:	✍	It is clarified that the DPDCH transmission starts directly after the end of the PCP, and thus the PCP transmission shall be aligned accordingly. It is also clarified that during the PCP no DPDCH transmission is done, indenpendent on the TFCI value during PCP.
Consequences if not approved:	✍	UE behaviour between the end of the PCP and the actual start of DPDCH transmission (which is bound to certain CFNs) is not specified. Also, the relation between selected TFC and no DPDCH transmission during the PCP is ambiguous.

Clauses affected:	✍	4.3.2.2, 5.1.2.4	
Other specs affected:	✍	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	✍
Other comments:	✍		

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4.3.2.2 No existing radio link

When one or several radio links are to be established and there is no existing radio link for the UE already, a dedicated physical channel is to be set up in uplink and at least one dedicated physical channel is to be set up in downlink. This corresponds to the case when a dedicated physical channel is initially set up on a frequency.

The radio link establishment is as follows:

a) Node B considers the radio link sets which are to be set up to be in the initial state. 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.

b) 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.

c) 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]. The total signalling response delay for the establishment of a new DPCH shall not exceed the requirements given in [8] sub-clause 7.3. ~~The uplink DPDCH transmission shall not start before the end of the power control preamble.~~ The ~~length~~ transmission of the uplink DPCCH power control preamble ~~is~~ shall start N_{pcp} radio frames ~~beginning at~~ prior to the start of the uplink ~~DPCCH~~ 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. During the uplink DPCCH power control preamble, independently on the selected TFC, no transmission is done on the DPDCH.

d) 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.

5.1.2.4 Transmit power control in the uplink DPCCH power control preamble

An ~~UL~~ uplink DPCCH power control preamble is a period of ~~UL~~ uplink DPCCH transmission prior to the start of the uplink DPDCH. The ~~DL~~ downlink DPCCH shall also be transmitted during an uplink DPCCH power control preamble.

The length of the uplink DPCCH power control preamble is a higher layer parameter signalled by the network as defined in [5]. The ~~UL~~ uplink DPDCH shall ~~not~~ commence ~~before~~ after the end of the uplink DPCCH power control preamble.

During the uplink DPCCH power control preamble the change in uplink DPCCH transmit power shall be given by:

? ? $_{DPCCH}$ = ? $_{TPC}$? TPC_cmd.

During the uplink DPCCH power control preamble TPC_cmd is derived according to algorithm 1 as described in sub clause 5.1.2.2.1, regardless of the value of PCA.

Ordinary power control (see subclause 5.1.2.2), with the power control algorithm determined by the value of PCA and step size ? $_{TPC,}$ shall be used after the end of the uplink DPCCH power control preamble.