TSG-RAN Meeting #11 ***RP-010065***
Palm Springs, CA, U.S.A., 13-16 March 2001

Title: **Agreed CRs to TS 25.224**

Source: **TSG-RAN WG1**

Agenda item: **5.1.3**

No.	R1 T-doc	Spec	CR	Rev	Subject	Cat	V_old	V_new
1	R1-01-0153	25.224	036	-	DTX and Special Burst Scheduling	F	3.5.0	3.6.0
2	R1-01-0351	25.224	037	1	RACH random access procedure	F	3.5.0	3.6.0
3	R1-01-0016	25.224	045	-	Introduction of closed-loop Tx diversity for the PDSCH and DTX for the PUSCH/PDSCH	F	3.5.0	3.6.0
4	R1-01-0358	25.224	046	2	Corrections of TDD power control sections	F	3.5.0	3.6.0
5	R1-01-0209	25.224	050	-	Use of a special burst in reconfiguration	F	3.5.0	3.6.0
6	R1-01-0252	25.224	053	-	Known TFCI for the TDD special burst	F	3.5.0	3.6.0

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CHANGE REQUEST

⌘ **25.224 CR 036** ⌘ 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: ⌘	DTX and Special Burst Scheduling		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘		***Date:*** ⌘	17 January, 2001
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: ⌘	Define a parameter to be provided by higher layers to specify the repetition period for special bursts during DTX
Summary of change: ⌘	Introduced NDTXU and NDTXD, which specify the repetition period for special bursts during DTX. Replaced an erroneous reference to an existing parameter, which is intended for another purpose.
Consequences if not approved: ⌘	Special Burst generation during DTX would fail to operate.

Clauses affected: ⌘	3, 4.5.1	
Other specs affected: ⌘	[X] Other core specifications ⌘	25.331, 25.423, 25.433
	[ ] Test specifications	
	[ ] O&M Specifications	
Other comments: ⌘		

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3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ASC	Access Service Class
BCCH	Broadcast Control Channel
BCH	Broadcast Channel
CCTrCH	Coded Composite Transport Channel
DCA	Dynamic Channel Allocation
DPCH	Dedicated Physical Channel
DTX	~~Discontinous~~Discontinuous Transmission
FACH	Forward Access Channel
NRT	Non-Real Time
P-CCPCH	Primary Common Control Physical Channel
PRACH	Physical Random Access Channel
RACH	Random Access Channel
RT	Real Time
RU	Resource Unit
SBGP	Special Burst Generation Gap
SBP	Special Burst Period
SBSP	Special Burst Scheduling Period
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SFN	System Frame Number
SSCH	Secondary Synchronisation Channel
STD	Selective Transmit Diversity
TA	Timing Advance
TPC	Transmit Power Control
TSTD	Time Switched Transmit Diversity
TxAA	Transmit Adaptive Antennas
UE	User Equipment
VBR	Variable Bit Rate

4.5 Discontinuous transmission (DTX) of Radio Frames

Discontinuous transmission (DTX) is applied in up- and downlink individually for each CCTrCH in case the total bit rate after transport channel multiplexing differs from the total channel bit rate of the dedicated physical channels allocated to a CCTrCH.

Rate matching is used in order to fill resource units completely, that are only partially filled with data. In the case that after rate matching and multiplexing no data at all is to be transmitted in a resource unit the complete resource unit is discarded from transmission. This applies also to the case where only one resource unit is allocated and no data has to be transmitted.

4.5.1 Use of Special Bursts fo DTX

In case there are no transport blocks provided for transmission by higher layers for any given CCTrCH after link establishment, then a Special Burst shall be transmitted in the first allocated frame of the transmission pause. If, including the first frame, there is a consecutive period of Special Burst Period (SBP) ~~N_OUTSYNC_IND/2-1~~ frames without transport blocks provided by higher layers, then another special burst shall be generated and transmitted at the next possible frame. This pattern shall be continued until transport blocks are provided for the CCTrCH by the higher layers. SBP shall be provided by higher layers . The value of SBP shall be independently specified for uplink and for downlink and shall be designated as

SBGP (special burst generation period) for uplink transmissions

SBSP (special burst scheduling parameter) for downlink transmissions

The default value for both SBGP and SBSP shall be 8.

This special burst shall have the same slot format as the burst used for data provided by higher layers. The special burst is filled with an arbitrary bit pattern, contains a TFCI and TPC bits if inner loop PC is applied and is transmitted for each CCTrCH individually on the physical channel which is defined to carry the TFCI. The TFCI of the special burst shall indicate that there were no transport blocks provided for transmission by higher layers as defined in [15]. The transmission power of the special burst shall be the same as that of the substituted physical channel of the CCTrCH carrying the TFCI.

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Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0351

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CHANGE REQUEST

⌘	**25.224**	**CR**	**037**	⌘	rev	**1**	⌘	Current version:	**3.5.0** ⌘

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

Title: ⌘	RACH random access procedure		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘		***Date:*** ⌘	28 February, 2001
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: ⌘	Current description of procedure is inconsistent, both internally and with higher layer Specification
Summary of change: ⌘	Procedure is rewritten to remove inconsistencies and to support alignment with other specifications. Sub-channels are defined for TDD. Parameters required from higher layers are clearly stated. Procedure for selection of sub-channel and channelization code are clearly stated.
Consequences if not approved: ⌘	Procedure will be ambiguous and incompatible with higher layer specifications

Clauses affected: ⌘	4.7.1 (new), 4.7.2	
Other specs affected: ⌘	[X] Other core specifications ⌘	25.331, 25.922, 25.302
	[ ] Test specifications	
	[ ] O&M Specifications	
Other comments: ⌘		

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4.7 Random access procedure

The physical random access procedure described below is invoked whenever a higher layer requests transmission of a message on the RACH. The physical random access procedure is controlled by primitives from RRC and MAC. Retransmission on the RACH in case of failed transmission (e.g. due to a collision) is controlled by higher layers. Thus, the backoff algorithm and associated handling of timers is not described here. The definition of the RACH in terms of PRACH sub-channels and associated Access Service Classes is broadcast on the BCH in each cell. Parameters for common physical channel uplink outer loop power control are also broadcast on the BCH in each cell. The UE needs to decode this information prior to transmission on the RACH.

4.7.1 PRACH sub-channels

A PRACH is defined by a timeslot and a channelization code, which is randomly selected from the PRACH Channelisation Code List [15] signaled by higher layers. In order to separate different ASCs each PRACH has N sub-channels associated with it (numbered from 0 to N-1). N may be assigned the value 1,2,4, or 8 by higher layer signaling.   Sub-channel i for a PRACH defined in timeslot k is defined as the kth slot in the frames where SFN mod N = i. Therefore follows the definition:

- Sub-channel i associated to a PRACH defined in timeslot k is defined as the kth timeslot in the frames where SFN mod N = i.

Figure 6 illustrates the eight possible subchannels for the case, N=8. For illustration, the figure assumes that the PRACH is assigned timeslot 3.

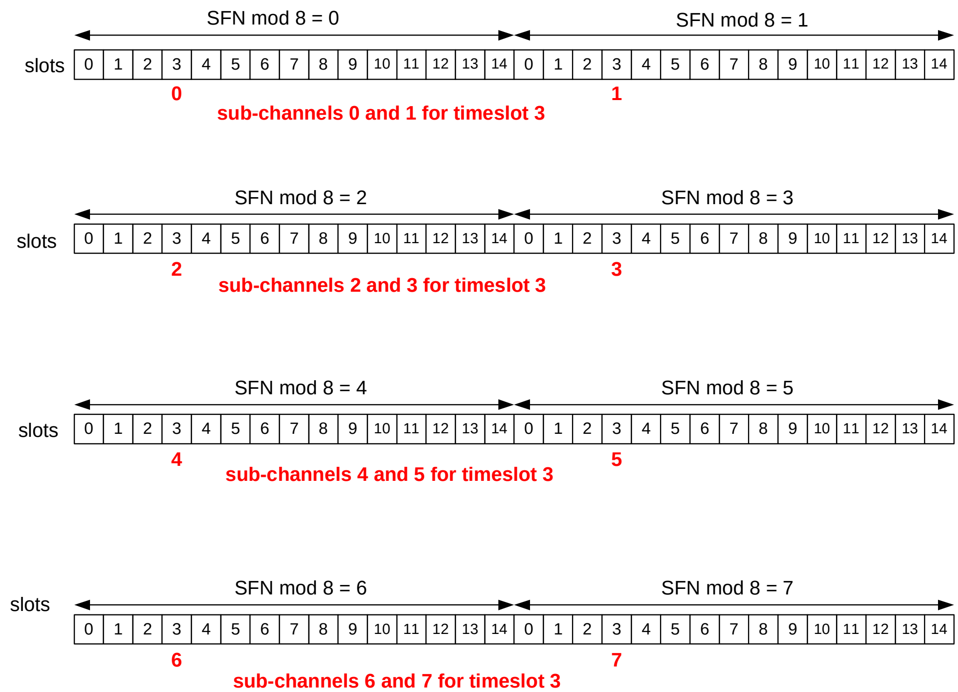

Figure 6. Eight sub-channels for timeslot 3

4.7.2~~1~~ Physical random access procedure

The physical random access procedure described in this subclause is initiated upon request of a PHY-Data-REQ primitive from the MAC sublayer (see [18] and [19]).
(Note: The selection of a PRACH is done by the RRC Layer.)

Before the physical random-access procedure can be initiated, Layer 1 shall receive the following information ~~by a CPHY-TrCH-Config-REQ~~ from the RRC layer~~:~~ using the primitives CPHY-TrCH-Config-REQ and CPHY-RL-Setup/Modify-REQ.

- the available PRACH sub-channels and channelization codes (There is a 1-1 mapping between the channelization code and the midamble shift as defined by RRC) for each Access Service Class (ASC)~~;~~of the selected PRACH (the selection of a PRACH is done by the RRC). CPHY-RL-Setup/Modify-REQ);

- the timeslot, spreading factor, ~~channelisation code,~~and midamble type(direct or inverted)~~, repetition period and offset~~ for the selected ~~each~~ PRACH ~~sub-channel. (There is a 1:1 mapping between spreading code and midamble as defined by RRC);~~(CPHY-RL-Setup/Modify-REQ);

- ~~-~~ the RACH~~set of~~ Transport Format ~~parameters~~(CPHY-TrCH-Config-REQ);

- the RACH transport channel identity (CPHY-TrCH-Config-REQ)

- the set of parameters for common physical channel uplink outer loop power control(CPHY-RL-Setup/Modify-REQ).

NOTE: The above parameters may be updated from higher layers before each physical random access procedure is initiated.

At each initiation of the physical random access procedure, Layer 1 shall receive the following information from the MAC higher layers (MAC):

- the Transport Format to be used for the PRACH message;
- the ASC of the PRACH transmission;
- the data to be transmitted (Transport Block Set).

The physical random-access procedure shall be performed as follows.:

1 Randomly select the PRACH sub-channel from the available ones for the given ASC. The random function shall be such that each of the allowed selections is chosen with equal probability.

2 Derive the available access slots in the next N frames, defined by SFN, SFN+1, ..., SFN+N-1 for the selected PRACH sub-channel with the help of SFN (where N is the repetition period of the selected PRACH sub-channel). Randomly select an uplink access slot from the available access slots in the next frame, defined by SFN, if there is one available. If there is no access slot available in the next frame, defined by SFN then, randomly select one access slot from the available access slots in the following frame, defined by SFN+1. This search is performed for all frames in increasing order, defined by SFN, SFN+1, ..., SFN+N-1, until an available access slot is found. The random function shall be such that each of the allowed selections is chosen with equal probability.

13 Randomly select a one channelization spreading code from the available ones set of designated codes for the selected given ASC. The random function shall be such that each of the code allowed selections is chosen with equal probability.

2 Determine tThe midamble shift to use, based on the selected channelization code.is derived from the selected spreading code.

3 Randomly select a sub-channel from the set of available sub-channels. The random function shall be such that each of the allowed selections is chosen with equal probability.

4 Set the PRACH message transmission power level according to the specification for common physical channels in uplink (see subclause 4.2.2.2).

5 Transmit the RACH Transport Block Set (the random access message) with no timing advance in the selected sub-channel using the selected channelization code..

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0016

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CHANGE REQUEST

⌘	**25.224**	**CR**	**045**	⌘ rev	**-**	⌘	Current version:	**3.5.0** ⌘

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

Title:	⌘	Introduction of closed-loop Tx diversity for the PDSCH and DTX for the PUSCH/PDSCH
Source:	⌘	TSG RAN WG1
Work item code:	⌘	
Date:	⌘	14 Dec. 2000
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)*

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Use one of the following releases:
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- *R96 (Release 1996)*
- *R97 (Release 1997)*
- *R98 (Release 1998)*
- *R99 (Release 1999)*
- *REL-4 (Release 4)*
- *REL-5 (Release 5)*

Reason for change:	⌘	The actual specification is incomplete with respect to the description of the PUSCH and PDSCH in TDD
Summary of change:	⌘	The CR proposes closed-loop Tx diversity for the PDSCH and DTX for the PUSCH and PDSCH.
Consequences if not approved:	⌘	The performance of the PDSCH can be enhanced easily by closed-loop Tx diversity without major modifications. Also, PUSCH and PDSCH should benefit from DTX.

Clauses affected:	⌘	4.5, 4.6, 4.6.1
Other specs affected:	⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications
Other comments:	⌘	

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4.5 Discontinuous transmission (DTX) of Radio Frames

Discontinuous transmission (DTX) is applied in up- and downlink individually for each CCTrCH in case the total bit rate after transport channel multiplexing differs from the total channel bit rate of the dedicated physical channels allocated to a CCTrCH.DTX is applied to CCTrCHs mapped to dedicated and shared physical channels (PUSCH, PDSCH, UL DPCH and DL DPCH), if the total bit rate of the CCTrCH differs from the total channel bit rate of the physical channels allocated to this CCTrCH.

Rate matching is used in order to fill resource units completely, that are only partially filled with data. In the case that after rate matching and multiplexing no data at all is to be transmitted in a resource unit the complete resource unit is discarded from transmission. This applies also to the case where only one resource unit is allocated and no data has to be transmitted.

4.5.1 Use of Special Bursts fo DTX

In case there are no transport blocks provided for transmission by higher layers for any given CCTrCH after link establishment, then a Special Burst shall be transmitted in the first allocated frame of the transmission pause. If there is a consecutive period of $\lceil$ N_OUTSYNC_IND/2-1 $\rceil$ frames without transport blocks provided by higher layers, then another special burst shall be generated and transmitted at the next possible frame. This pattern shall be continued until transport blocks are provided for the CCTrCH by the higher layers.

This special burst shall have the same slot format as the burst used for data provided by higher layers. The special burst is filled with an arbitrary bit pattern, contains a TFCI and TPC bits if inner loop PC is applied and is transmitted for each CCTrCH individually on the physical channel which is defined to carry the TFCI. The TFCI of the special burst shall indicate that there were no transport blocks provided for transmission by higher layers as defined in [15]. The transmission power of the special burst shall be the same as that of the substituted physical channel of the CCTrCH carrying the TFCI.

4.5.2 Use of Special Bursts for Initial Establishment

Upon initial establishment and either 160 ms following detection of in-sync, or until the first transport block is received from higher layers, both the UE and the Node B shall transmit the special burst for each CCTrCH for each assigned resource which was scheduled to include a TFCI.

4.6 Downlink Transmit Diversity

Downlink transmit diversity for PDSCH, DPCH, P-CCPCH, and SCH is optional in UTRAN. Its support is mandatory at the UE.

4.6.1 Transmit Diversity for PDSCH and DPCH

The transmitter structure to support transmit diversity for PDSCH and DPCH transmission is shown in figure 1. 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. These weight factors are calculated on a per slot and per user basis.

The weight factors are determined by the UTRAN. Examples of transmit diversity schemes are given in annex B.

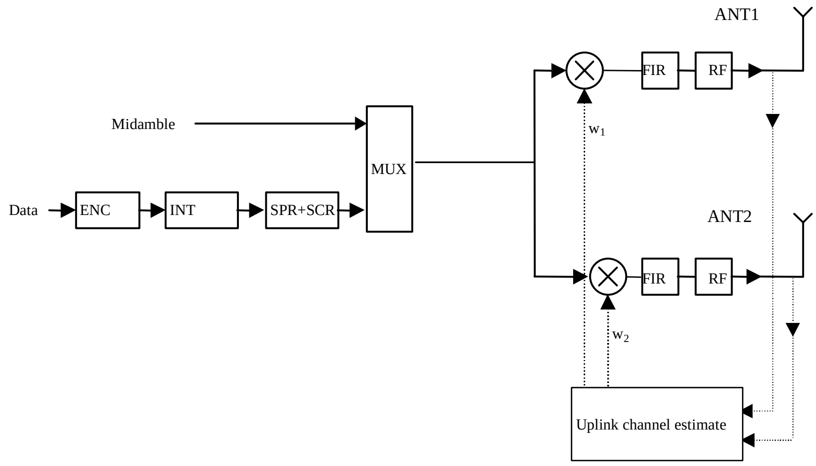

Figure 1: Downlink transmitter structure to support Transmit Diversity for PDSCH and DPCH transmission (UTRAN Access Point)

4.6.2 Transmit Diversity for SCH

Time Switched Transmit Diversity (TSTD) can be employed as transmit diversity scheme for the synchronisation channel.

4.6.2.1 SCH Transmission Scheme

The transmitter structure to support transmit diversity for SCH transmission is shown in figure 2. P-SCH and S-SCH are transmitted from antenna 1 and antenna 2 alternatively. An example for the antenna switching pattern is shown in figure 3.

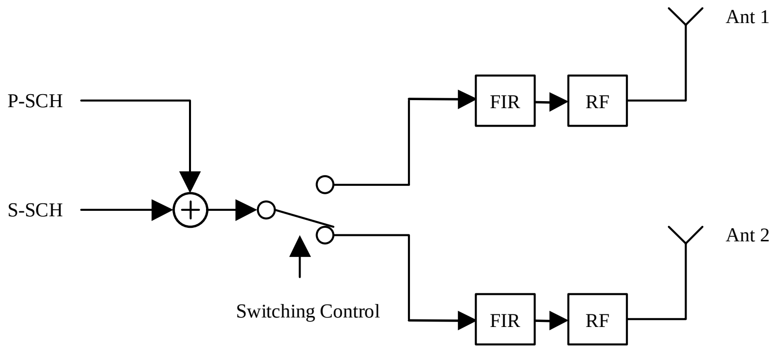

Figure 2: Downlink transmitter structure to support Transmit Diversity for SCH transmission (UTRAN Access Point)

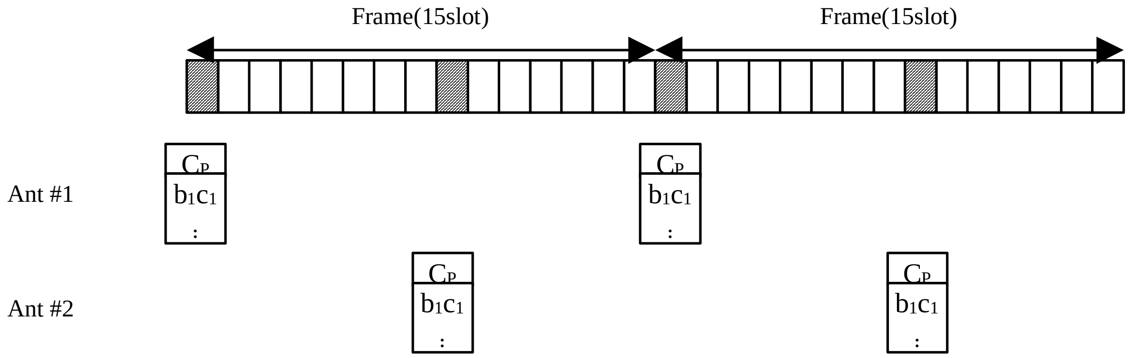

Figure 3: Antenna Switching Pattern (Case 2)

4.6.3 Transmit Diversity for P-CCPCH

Block Space Time Transmit Diversity (Block STTD) may be employed as transmit diversity scheme for the Primary Common Control Physical Channels (P-CCPCH).

4.6.3.1 P-CCPCH Transmission Scheme

The open loop downlink transmit diversity employs a Block Space Time Transmit Diversity scheme (Block STTD).

A block diagram of the Block STTD transmitter is shown in figure 4. Before Block STTD encoding, channel coding, rate matching, interleaving and bit-to-symbol mapping are performed as in the non-diversity mode.

Block STTD encoding is separately performed for each of the two data fields present in a burst (each data field contains N data symbols). For each data field at the encoder input, 2 data fields are generated at its output, corresponding to each of the diversity antennas. The Block STTD encoding operation is illustrated in figure 5, where the superscript * stands for complex conjugate. If N is an odd number, the first symbol of the block shall not be STTD encoded and the same symbol will be transmitted with equal power from both antennas.

After Block STTD encoding both branches are separately spread and scrambled as in the non-diversity mode.

The use of Block STTD encoding will be indicated by higher layers.

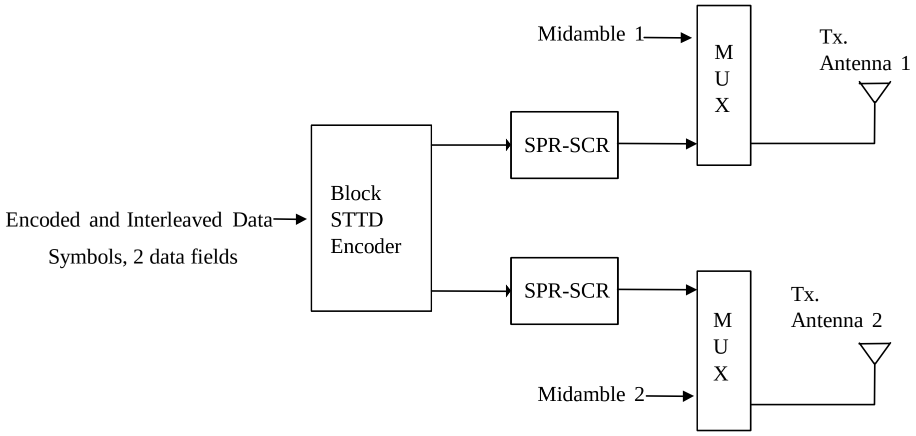

Figure 4: Block Diagram of the transmitter (STTD)

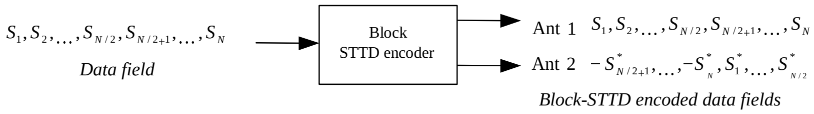

Figure 5: Block Diagram of Block STTD encoder. The symbols S_i are QPSK. N is the length of the block to be encoded

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CHANGE REQUEST

⌘ **25.224 CR 046**	⌘ rev **2**	⌘ Current version: **3.5.0** ⌘

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

Title: ⌘	Corrections of TDD power control sections		
Source: ⌘	TSG RAN WG1		
Work item code: ⌘		***Date:*** ⌘	28 Feb. 2001
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: ⌘	The description of the open loop power control is given in 25.224 and 25.331. This is an unnecessary duplication. Also, the general power control limits are described insufficiently and the behaviour, if the maximum Node B transmit power is exceeded, is not optimal.
Summary of change: ⌘	This CR removes the description of the open loop power control in 25.224 and clarifies the description of the general power control limits. It is also proposed to scale not only the DPCH, but also the PDSCH, if the maximum Node B transmit power is exceeded. In addition to this a description of a possible power control structure is given in the informative annex. Some minor clarifications are also proposed to remove potential ambiguities.
Consequences if not approved: ⌘	The actual specification is not optimal with respect to the behaviour at the downlink power control limit. With respect to the other points mentioned above, the actual specification could lead to misunderstandings.

Clauses affected: ⌘	4.2, Annex A	
Other specs affected: ⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments: ⌘		

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4.2 Transmitter Power Control

4.2.1 General Parameters

Power control is applied for the TDD mode to limit the interference level within the system thus reducing the intercell interference level and to reduce the power consumption in the UE.

All codes within one timeslot allocated to the same CCTrCH use the same transmission power, in case they have the same spreading factor.

Table 1: Transmit Power Control characteristics

	Uplink	Downlink
Power control rate	Variable 1-7 slots delay (2 slot SCH) 1-14 slots delay (1 slot SCH)	Variable, with rate depending on the slot allocation.
TPC Step size	--	1dB or 2 dB or 3 dB~~1, 2, 3 dB~~
Remarks	All figures are without processing and measurement times	Within one timeslot the powers of all active codes may be balanced to within a range of 20 dB

4.2.2 Uplink Control

4.2.2.1 General Limits

During the operation of the uplink power control procedure the UE transmit power shall not exceed a maximum allowed value which is the lower out of the maximum output power of the terminal power class and a value which may be set by higher layer signalling.

Uplink power control shall be performed while the total UE transmit power is below the maximum allowed output power. In some cases the total UE transmit power in a timeslot after uplink power control calculation might exceed the maximum allowed output power. In these cases the calculated transmit power of all uplink physical channels in this timeslot shall be scaled by the same amount in dB before transmission. The total UE transmission power used shall be the maximum allowed output power.

The UTRAN may not expect the UE to be capable of reducing its total transmit power below the minimum level specified in [2].

~~By means of higher layer signalling, the Maximum_Allowed_UL_TX_ power for uplink may be set to a value lower than what the terminal power class is capable of. The total transmit power shall not exceed the allowed maximum. If this would be the case, then the transmit power of all uplink physical channels in a timeslot is reduced by the same amount in dB.~~

4.2.2.2 PRACH

The transmit power for the PRACH is set by higher layers based on open loop power control as described in [15].

4.2.2.3 DPCH, PUSCH

The transmit power for DPCH and PUSCH is set by higher layers based on open loop power control as described in [15].

4.2.2.3.1 Gain Factors

Two or more transport channels may be multiplexed onto a CCTrCH as described in [9]. -These transport channels undergo rate matching which involves repetition or puncturing. -This rate matching affects the transmit power required to obtain a particular E_b/N_0. Thus, the transmission power of the CCTrCH shall be weighted by a gain factor β.

There are two ways of controlling the gain factors for different TFC's within a CCTrCH transmitted in a radio frame:

- β is signalled for the TFC, or
- β is computed for the TFC, based upon the signalled settings for a reference TFC.

Combinations of the two above methods may be used to associate β values to all TFC's in the TFCS for a CCTrCH. The two methods are described in sections 4.2.2.3.1.1 and 4.2.2.3.1.2 respectively. Several reference TFC's for several different CCTrCH's may be signalled from higher layers.

The weight and gain factors may vary on a radio frame basis depending upon the current SF and TFC used. The setting of weight and gain factors is independent of any other form of power control. That means that the transmit power P_{UL} is calculated according to the formula given in [15] ~~below in section 4.2.2.3.2~~ and then the weight and gain factors are applied on top of that, cf. [10].

4.2.2.3.1.1 Signalled Gain Factors

When the gain factor β_j is signalled by higher layers for a certain TFC, the signalled values are used directly for weighting DPCH~~(s)~~ or PUSCH within a CCTrCH. Exact values are given in [10].

4.2.2.3.1.2 Computed Gain Factors

The gain factor β_j may also be computed for certain TFCs, based on the signalled settings for a reference TFC:

Let β_{ref} denote the signalled gain factor for the reference TFC. Further, let β_j denote the gain factor used for the j-th TFC.

Define the variable: $K_{ref} = \sum_i RM_i \cdot N_i$

where RM_i is the semi-static rate matching attribute for transport channel i, N_i is the number of bits output from the radio frame segmentation block for transport channel i and the sum is taken over all the transport channels i in the reference TFC.

Similarly, define the variable $K_j = \sum_i RM_i \cdot N_i$

where the sum is taken over all the transport channels i in the j-th TFC.

Moreover, define the variable $L_{ref} = \sum_i \frac{1}{SF_i}$

where SF_i is the spreading factor of DPCH or PUSCH i and the sum is taken over all DPCH or PUSCH i used in the reference TFC.

Similarly, define the variable $L_j = \sum_i \frac{1}{SF_i}$

where the sum is taken over all DPCH or PUSCH i used in the j-th TFC.

Then the variable A_j, called the nominal power relation for TFC j, is computed as:

$$A_j = \sqrt{\frac{L_j}{L_{ref}}} \times \sqrt{\frac{K_{ref}}{K_j}}$$

The gain factors β_j for the j-th TFC are then computed as follows:

- If $A_j > 1$, then β_j is the largest quantized β-value, for which the condition $\beta_j \leq 1 / A_j$ holds.
- If $A_j \leq 1$, then β_j is the smallest quantized β-value, for which the condition $\beta_j \geq 1 / A_j$ holds.

The quantized β-values are given in [10].

~~4.2.2.3.2 Power Control Loop~~

~~After the synchronisation between UTRAN and UE is established, the UE transits into open-loop transmitter power control (TPC).~~

~~The power setting for each uplink DPCH in one CCTrCH shall be calculated by the following equation:~~

$P_{UL} = \alpha L_{P-CCPCH} + (1-\alpha)L_0 + I_{BTS} + SIR_{TARGET} + \text{Constant value}$

~~where~~

~~P_{UL}: Power setting in dBm, cf. section "Combination of physical channels in uplink" in [10]; This value corresponds to a particular CCTrCH (due to CCTrCH-specific SIR_{TARGET}) and a particular timeslot (due to possibly timeslot-specific α and I_{BTS}).~~

~~$L_{P-CCPCH}$: Measure representing path loss in dB (reference transmit power is broadcast on BCH).~~

~~L_0: Long term average of path loss in dB.~~

~~I_{BTS}: Interference signal power level at cell's receiver in dBm, which is broadcast on BCH.~~

~~α: α is a weighting parameter which represents the quality of path loss measurements. α may be a function of the time delay between the uplink time slot and the most recent down link time slot containing a beacon channel, see [8]. α shall be calculated autonomously at the UE, subject to a maximum allowed value which shall be signalled by higher layers. An example for calculating α as a function of the time delay is given in annex A.1.~~

~~SIR_{TARGET}: Target SIR in dB. A higher layer outer loop adjusts the target SIR.~~

~~Constant value: This value shall be set by higher Layer (operator matter). and is broadcast on BCH.~~

~~If the midamble is used in the evaluation of $L_{P-CCPCH}$ and L_0, and the Tx diversity scheme used for the P-CCPCH involves the transmission of different midambles from the diversity antennas, the received power of the different midambles from the different antennas shall be combined prior to evaluation of these variables.~~

4.2.2.3.2~~3~~ Out of synchronisation handling

As stated in 4.2.3.3, the association between TPC commands sent on uplink DPCH and PUSCH, with the power controlled downlink DPCH and PDSCH is signaled by higher layers. In the case of multiple DL CCTrCHs it is possible that an UL CCTrCH will provide TPC commands to more than one DL CCTrCH.

In the second phase of synchronisation evaluation, as defined in 4.4.2.1.2, the UE shall shut off the transmission of an UL CCTrCH if the following criteria are fulfilled for any one of the DL CCTrCHs commanded by its TPC:

- The UE estimates the received dedicated channel burst quality over the last 160 ms period to be worse than a threshold Q_{out}, and in addition, no special burst, as defined in 4.5, is detected with quality above a threshold, Q_{sbout}. Q_{out} and Q_{sbout} are defined implicitly by the relevant tests in [2]. If the UE detects the beacon channel reception level [10 dB] above the handover triggering level, then the UE shall use a 320 ms estimation period for the burst quality evaluation and for the Special Burst detection window.

UE shall subsequently resume the uplink transmission of the CCTrCH if the following criteria are fulfilled:

- The UE estimates the received dedicated CCTrCH burst reception quality over the last 160 ms period to be better than a threshold Q_{in} or the UE detects a burst with quality above threshold Q_{sbin} and TFCI decoded to be that of the Special Burst. Q_{in} and Q_{sbin} are defined implicitly by the relevant tests in [2]. If the UE detects the beacon channel reception level [10 dB] above the handover triggering level, then the UE shall use a 320 ms estimation period for the burst quality evaluation and for the Special Burst detection window.

4.2.3 Downlink Control

4.2.3.1 P-CCPCH

The Primary CCPCH transmit power is set by higher layer signalling and can be changed based on network conditionsdetermination on a slow basis. The -reference transmit power of the P-CCPCH is broadcast on BCH or individually signalled to each UEsignalled on the BCH.

4.2.3.2 S-CCPCH, PICH

The relative transmit power of the Secondary CCPCH and the PICH compared to the P-CCPCH transmit power are set by higher layer signalling. The PICH power offset relative to the P-CCPCH reference power is signalled on the BCH.

4.2.3.3 SCH

The SCH transmit power is set by higher layer signalling [16]. The value is given relative to the power of the P-CCPCH.

4.2.3.43 DPCH, PDSCH

The initial transmission power of the downlink DPCH and the PDSCH is set by the network. After the initial transmission, the UTRAN transits into SIR-based inner loop power control.

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

The initial transmission power of the downlink DPCH and the PDSCH shall be set by the network. If associated uplink CCTrCHs for TPC commands are signalled to the UE by higher layers (mandatory for a DPCH), the network shall transit into inner loop power control after the initial transmission. The UE shall then generate TPC commands to control the network transmit power and send them in the TPC field of the associated uplink CCTrCHs. An example on how to derive the TPC commands and the definition of the inner loop power control are given in Annex A.1. A TPC command sent in an uplink CCTrCH controls all downlink DPCHs or PDSCHs to which the associated downlink CCTrCH is mapped to.

The association between TPC commands sent on uplink DPCH and PUSCH, with the power controlled downlink DPCH and PDSCH is signalled by higher layers.

In the case that no associated downlink data is scheduled within 15 timeslots before the transmission of a TPC command then this is regarded as a transmission pause. The TPC commands in this case shall be derived from measurements on the P-CCPCH. An example solution for the generation of the TPC command for this case is given in Annex A 12.

Each TPC command shall always be based on all associated downlink transmissions received since the previous related TPC command. Related TPC commands are defined as TPC commands associated with the same downlink CCTrCHs. If there are no associated downlink transmissions between two or more uplink transmissions carrying related TPC commands, then these TPC commands shall be identical and they shall be regarded by the UTRAN as a single TPC command. This rule applies both to the case where the TPC commands are based on measurements are based on a on the associated CCTrCH or, in the case of a transmission pause, on the P-CCPCH.

As a response to the received TPC command, UTRAN may adjust the transmit power. When the TPC command is judged as "down", the transmission power may be reduced by the TPC step sizeone step, whereas if judged as "up", the transmission power may be raised by the TPC step size.one step.

The UTRAN may apply an individual offset to the transmission power in each timeslot according to the downlink interference level at the UE.

The transmission power of one DPCH or PDSCH shall not exceed the limits set by higher layer signalling by means of Maximum_DL_Power (dB) and Minimum_DL_Power (dB). The transmission power is defined as the average power over one timeslot of the complex QPSK symbols of a single DPCH or PDSCH before spreading relative to the power of the P-CCPCH.

During a downlink transmission pause, both UE and Node B shall use the same TPC step size which is signalled by higher layers. ~~the~~ The UTRAN may accumulate~~d~~ the TPC commands received during the pause. TPC commands that shall be regarded as identical may only be counted once. The initial UTRAN transmission power for the first data transmission after the pause may then be set to the sum of transmission power before the pause and a power offset according to the accumulated TPC commands. Additionally this sum may include a constant set by the operator and a correction term due to uncertainties in the reception of the TPC bits.

The total downlink transmission power at the Node B~~nodeB~~ within one timeslot shall not exceed Maximum Transmission Power set by higher layer signalling. ~~In case the total power of the sum of all transmissions~~ If the total transmit power of all channels in a timeslot ~~would~~ exceeds this limit, then the transmission power of all downlink DPCHs and PDSCHs shall be~~is~~ reduced by the same amount in dB. The value for this power reduction is determined, so that the total transmit power of all channels in this timeslot is equal to the maximum transmission power.~~that allows fulfilling the requirement. The same amount of power reduction is applied to all DPCHs.~~

~~A higher layer outer loop adjusts the target SIR.~~

4.2.3.4~~3~~.1 Out of synchronisation handling

When the dedicated physical channel out of sync criteria based on the received burst quality is as given in the subclause 4.4.2 then the UE shall set the uplink TPC command = "up". The CRC based criteria shall not be taken into account in TPC bit value setting.

Annex A (informative): Power Control

~~A.1 An Example for Calculating α~~

~~This annex presents an example for calculating the path loss weighting parameter for open loop power control α.~~

~~α can be calculated as α = 1-(D-1)/6 where D is the delay, expressed in number of slots, between the uplink slot and the most recent downlink slot. Note that α=1 for a delay of one slot (minimal delay), and α=0 for a delay of 7 slots (maximal delay).~~

A.1~~2~~ Example Implementation of Downlink Power Control in the UE

The power control may be realized by two cascaded control loops. The outer loop controls the transmission quality, whose reference value is set by higher layers [15], by providing the reference value for the inner loop. This reference value should be the SIR at the UE [15]. The inner loop controls the physical quantity for which the outer loop produces the reference value (e. g. the SIR) by generating TPC commands. This may be done by comparing the measured SIR to its reference value. ~~The measurement of received SIR shall be carried out periodically at the UE.~~ When the measured value is higher than the target SIR value, TPC command = "down". When this is lower than or equal to the target SIR value, TPC command = "up".

In case of a downlink transmission pause on the DPCH or PDSCH, the receive power (RSCP) of the data can no longer be used for inner loop SIR calculations in the UE. In this case ~~v~~the UE should trace the fluctuations of the pathloss based on the P-CCPCH and use these values instead for generating the TPC commands. This pathloss together with the timeslot ISCP measurement in the data timeslot, which is ongoing, should be used to calculate a virtual SIR value:

$SIR_{virt}(i) = RSCP_{virt}(i) - ISCP(i)$,

$RSCP_{virt}(i) = RSCP_0 + L_0 - L(i) + \sum_{k=1}^{i-1} TPC(k)$,

RSCP:	Received signal code power in dBm
ISCP:	Interference signal code power in the DPCH / PDSCH timeslot in dBm
L:	pathloss in dB measured on the P-CCPCH. The same weighting of the long- and short-term pathloss should be used as for uplink open loop power control, see Annex A.1
i:	index for the frames during a transmission pause, $1 \le i \le$ number of frames in the pause
L_0:	weighted pathloss in the last frame before the transmission pause in dB
$RSCP_0$:	RSCP of the data that was used in the SIR calculation of the last frame before the pause in dBm
TPC (k):	± power control stepsize in dB according to the TPC bit generated and transmitted in frame k, TPC bit "up" = +stepsize, TPC bit "down" = –stepsize

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0209

CR-Form-v3

CHANGE REQUEST

⌘	**25.224**	**CR**	**050**	⌘ rev	**-**	⌘	Current version:	**3.5.0** ⌘

*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:	⌘ Use of a Special Burst in reconfiguration		
Source:	⌘ TSG RAN WG1		
Work item code:	⌘	***Date:***	⌘ Feb. 20, 2001
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: ⌘	The usage of Special Burst during reconfiguration is not stated in the current specification.
Summary of change: ⌘	It is added that the Special Burst may be used in reconfiguration. Also, a typing error is corrected.
Consequences if not approved: ⌘	._The description of the usage of Special Burst will be incomplete.

Clauses affected: ⌘	4.5.1, 4.5.2	
Other specs affected: ⌘	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	⌘
Other comments: ⌘		

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4.5.1 Use of Special Bursts for DTX

In case there are no transport blocks provided for transmission by higher layers for any given CCTrCH after link establishment, then a Special Burst shall be transmitted in the first allocated frame of the transmission pause. If there is a consecutive period of $\lceil$ N_OUTSYNC_IND/2-1$\rceil$ frames without transport blocks provided by higher layers, then another special burst shall be generated and transmitted at the next possible frame. This pattern shall be continued until transport blocks are provided for the CCTrCH by the higher layers.

This special burst shall have the same slot format as the burst used for data provided by higher layers. The special burst is filled with an arbitrary bit pattern, contains a TFCI and TPC bits if inner loop PC is applied and is transmitted for each CCTrCH individually on the physical channel which is defined to carry the TFCI. The TFCI of the special burst shall indicate that there were no transport blocks provided for transmission by higher layers as defined in [15]. The transmission power of the special burst shall be the same as that of the substituted physical channel of the CCTrCH carrying the TFCI.

4.5.2 Use of Special Bursts for Initial Establishment/Reconfiguration

Upon initial establishment or reconfiguration for ~~and~~ either 160 ms following detection of in-sync, or until the first transport block is received from higher layers, both the UE and the Node B shall transmit the special burst for each CCTrCH for each assigned resource which was scheduled to include a TFCI.

3GPP TSG RAN Meeting #11
Palm Springs, CA, U.S.A., March 13-16, 2001

R1-01-0252

CR-Form-v3

CHANGE REQUEST

⌘	**25.224**	**CR**	**053**	⌘	rev	**-**	⌘	Current version:	**3.5.0**	⌘

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

Title:	⌘	Known TFCI for the TDD Special Burst
Source:	⌘	TSG RAN WG1
Work item code:	⌘	
Date:	⌘	February 20, 2001
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 TDD Special Bursts are required for periodic DTX transmissions and establishment of dedicated physical channels. The Special Burst is recognised by a “known” TFCI. This TFCI is currently specified as the TFCI that corresponds to “no transport blocks” as defined in 25.331. In order to define this TFCI in the UE and Node-B it is necessary to signal TF’s for all TrCH’s within the particular CCTrCH that indicate no TB’s, and the corresponding TFC in the TFCS. This additional signalling can be avoided with a hard coded TFCI as is used in FDD for similar purposes (UL DPDCH establishment).
Summary of change:	⌘	Special Burst TFCI is specified to be filled with “0” bits.
Consequences if not approved:	⌘	Unnecessary signalling overhead is required for all dedicated channel configurations including handover cases.ecification

Clauses affected:	⌘	4.5		
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.

4.5 Discontinuous transmission (DTX) of Radio Frames

Discontinuous transmission (DTX) is applied in up- and downlink individually for each CCTrCH in case the total bit rate after transport channel multiplexing differs from the total channel bit rate of the dedicated physical channels allocated to a CCTrCH.
Rate matching is used in order to fill resource units completely, that are only partially filled with data. In the case that after rate matching and multiplexing no data at all is to be transmitted in a resource unit the complete resource unit is discarded from transmission. This applies also to the case where only one resource unit is allocated and no data has to be transmitted.

4.5.1 Use of Special Bursts fo DTX

In case there are no transport blocks provided for transmission by higher layers for any given CCTrCH after link establishment, then a Special Burst shall be transmitted in the first allocated frame of the transmission pause. If there is a consecutive period of ⌈N_OUTSYNC_IND/2-1⌉ frames without transport blocks provided by higher layers, then another special burst shall be generated and transmitted at the next possible frame. This pattern shall be continued until transport blocks are provided for the CCTrCH by the higher layers.
This special burst shall have the same slot format as the burst used for data provided by higher layers. The special burst is filled with an arbitrary bit pattern, contains a TFCI and TPC bits if inner loop PC is applied and is transmitted for each CCTrCH individually on the physical channel which is defined to carry the TFCI. The TFCI of the special burst if filled with "0" bits. ~~shall indicate that there were no transport blocks provided for transmission by higher layers as defined in [15].~~ The transmission power of the special burst shall be the same as that of the substituted physical channel of the CCTrCH carrying the TFCI.

4.5.2 Use of Special Bursts for Initial Establishment

Upon initial establishment and either 160 ms following detection of in-sync, or until the first transport block is received from higher layers, both the UE and the Node B shall transmit the special burst for each CCTrCH for each assigned resource which was scheduled to include a TFCI.