TSG-RAN Meeting #8 ***RP-000274***
Düsseldorf, Germany, 21-23 June 2000

Title: **Agreed CRs to TS 25.224**

Source: **TSG-RAN WG1**

Agenda item: **5.1.3**

No.	Doc #	Spec	CR	Rev	Subject	Cat	Current_v	New_v
1	R1-000466	25.224	016	-	Editorial correction for the power control section in	D	3.2.0	3.3.0
2	R1-000511	25.224	017	-	Power control for TDD during DTX	F	3.2.0	3.3.0
3	R1-000584	25.224	018	1	Power Control for PDSCH	F	3.2.0	3.3.0
4	R1-000729	25.224	020	1	Editorial modification of 25.224	D	3.2.0	3.3.0
5	R1-000652	25.224	021	-	Clarifications on TxDiversity for UTRA TDD	D	3.2.0	3.3.0
6	R1-000728	25.224	022	1	Introduction of the TDD DSCH detection	F	3.2.0	3.3.0
7	R1-000777	25.224	023	-	Downlink power control on timeslot basis	C	3.2.0	3.3.0

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Document *R1-00-0466*
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25.224 CR 016 Current Version: 3.2.0

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

For submission to: TSG RAN #8
list expected approval meeting # here ↑

for approval	X	strategic		*(for SMG use only)*
for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 28 March, 2000

Subject: Editorial correction for the power control section in 25.224

Work item: TS 25.224

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

F	Correction		
A	Corresponds to a correction in an earlier release		
B	Addition of feature		
C	Functional modification of feature		
D	Editorial modification	X	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Making TPC definition for setting power up consistent with other sections of the specification.

Clauses affected: 4.2.3.3.1

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

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4.2.3.3 Dedicated Physical Channel

The initial transmission power of the downlink Dedicated Physical Channel is set by the network. After the initial transmission, the UTRAN transits into SIR-based inner loop power control.
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”.
As a response to the received TPC command, UTRAN may adjust the transmit power of all downlink DPCHs of this radio link. When the TPC command is judged as “down”, the transmission power may be reduced by one step, whereas if judged as “up”, the transmission power may be raised by one step. The transmission power of one DPCH 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 of the complex QPSK symbols of a single DPCH before spreading.
The total downlink transmission power at the 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 would exceed this limit, then the transmission power of all downlink DPCHs is reduced by the amount 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.

4.2.3.3.1 Out of synchronisation handling

When the dedicated physical channel out of sync criteria based on the received burst quality is as given in the section 4.4.2 then the UE shall set the uplink TPC command = “up" ~~TPC bit = „1„~~.
The CRC based criteria shall not be taken into account in TPC bit value setting.

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25.224 CR 017 Current Version: 3.2.0

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

For submission to: TSG RAN#8	for approval	X	strategic		*(for SMG use only)*
List expected approval meeting # here ↑	for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-04-04

Subject: Power Control for TDD during DTX

Work item:

Category:				**Release:**	
	F	Correction	X	Phase 2	
	A	Corresponds to a correction in an earlier release		Release 96	
(only one category	B	Addition of feature		Release 97	
shall be marked	C	Functional modification of feature		Release 98	
with an X)	D	Editorial modification		Release 99	X
				Release 00	

Reason for change: The inner loop power control description is moved to an informative annex as requested by the RAN AdHoc
The procedure in the UE in case of downlink DTX was missing and is included in this CR.

Clauses affected: 4.2.3, 4.2.3, Annex A

Other specs affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments:

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4.2.2 Uplink Control

4.2.2.1 General Limits

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

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

The transmitter power of UE shall be calculated by the following equation:

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

where

P_{UE} : Transmitter power level in dBm,

$L_{P\text{-}CCPCH}$: 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 physical channel that provides the beacon function, see [8]. α is calculated at the UE. An example for calculating α as a function of the time delay is given in Annex A.1.

SIR_{TARGET}: Target SNR 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 $L_{P\text{-}CCPCH}$ 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.

4.2.2.3.1 Out of synchronisation handling

UE shall shut off the uplink transmission if the following criteria is fulfilled:

- The UE estimates the received dedicated channel burst quality over the last [160] ms period to be worse than a threshold Q_{out}. This criterion is never fulfilled during the first [160] ms of the dedicated channel's existence. Q_{out} is defined implicitly by the relevant tests in TS 25.102
- If the UE detect the beacon channel reception level [10 dBm] above the handover triggering level, then the UE uses [320] ms estimation period for the burst quality evaluation.

UE shall resume the uplink transmission if the follwowing criteria is fulfilled:

- The UE estimates the burst reception quality over the last [160] ms period to be better than a threshold Q_{in}. This criterion is always fulfilled during the first [160] ms of the dedicated channel's existence. Q_{in} is defined implicitly by the relevant tests in TS 25.102.

4.2.3 Downlink Control

4.2.3.1 P-CCPCH, PICH

The Primary CCPCH transmit power is set by higher layer signalling and can be changed based on network determination on a slow basis. The reference transmit power of the P-CCPCH is signalled on the BCH. The PICH is transmitted with the same power as the P-CCPCH.

4.2.3.2 S-CCPCH

The relative transmit power of the Secondary CCPCH compared to the P-CCPCH transmit power is set by higher layer signalling.

4.2.3.3 Dedicated Physical Channel

The initial transmission power of the downlink Dedicated Physical Channel 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 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".~~

As a response to the received TPC command, UTRAN may adjust the transmit power of all downlink DPCHs of this radio link. When the TPC command is judged as "down", the transmission power may be reduced by one step, whereas if judged as "up", the transmission power may be raised by one step. The transmission power of one DPCH 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 of the complex QPSK symbols of a single DPCH before spreading.

During a downlink transmission pause, the UTRAN may accumulated the TPC commands received. 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 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 would exceed this limit, then the transmission power of all downlink DPCHs is reduced by the amount 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.

4.2.3.3.1 Out of synchronisation handling

When the dedicated physical channel out of sync criteria based on the received burst quality is as given in the section 4.4.2 then the UE shall set the uplink TPC bit = „1„ . 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 $\alpha = 1-(D-1)/6$ where D is the delay, expressed in number of slots, between the uplink slot and the most recent downlink slot. Note that $\alpha=1$ for a delay of one slot (minimal delay), and $\alpha=0$ for a delay of 7 slots (maximal delay).

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

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 casevthe 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 dB
ISCP:	Interference signal code power in the DPCH / PDSCH timeslot in dB
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
$RSCP_0$:	RSCP of the data that was used in the SIR calculation of the last frame before the pause
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

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25.224	**CR**	**018r1**	Current Version:	3.2.0

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

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Proposed change affects: *(at least one should be marked with an X)*

(U)SIM		ME	X	UTRAN / Radio	X	Core Network	

Source:	TSG RAN WG1	**Date:**	2000-04-12
Subject:	Power Control for PDSCH		
Work item:			

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

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

Reason for change: Inclusion PDSCH into the power control description

Clauses affected: 4.2.2.2, 4.2.3.3

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

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4.2.2 Uplink Control

4.2.2.1 General Limits

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 TS 25.331~~[15]~~.

4.2.2.3 DPCH, PUSCH

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

The transmitter power of UE shall be calculated by the following equation:

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

where

P_{UE} : Transmitter power level in dBm,

$L_{P\text{-}CCPCH}$: 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 physical channel that provides the beacon function, see [8]. α is calculated at the UE. An example for calculating α as a function of the time delay is given in Annex 1.

SIR_{TARGET}: Target SNR 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 $L_{P\text{-}CCPCH}$ 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.

4.2.2.3.1 Out of synchronisation handling

UE shall shut off the uplink transmission if the following criteria is fulfilled:

- The UE estimates the received dedicated channel burst quality over the last [160] ms period to be worse than a threshold Q_{out}. This criterion is never fulfilled during the first [160] ms of the dedicated channel's existence. Q_{out} is defined implicitly by the relevant tests in TS 25.102

- If the UE detect the beacon channel reception level [10 dBm] above the handover triggering level, then the UE uses [320] ms estimation period for the burst quality evaluation.

UE shall resume the uplink transmission if the follwowing criteria is fulfilled:

- The UE estimates the burst reception quality over the last [160] ms period to be better than a threshold Q_{in}. This criterion is always fulfilled during the first [160] ms of the dedicated channel's existence. Q_{in} is defined implicitly by the relevant tests in TS 25.102.

4.2.3 Downlink Control

4.2.3.1 P-CCPCH, PICH

The Primary CCPCH transmit power is set by higher layer signalling and can be changed based on network determination on a slow basis. The reference transmit power of the P-CCPCH is signalled on the BCH. The PICH is transmitted with the same power as the P-CCPCH.

4.2.3.2 S-CCPCH

The relative transmit power of the Secondary CCPCH compared to the P-CCPCH transmit power is set by higher layer signalling.

4.2.3.3 Dedicated Physical Channel, PDSCH

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

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”.

As a response to the received TPC command, UTRAN may adjust the transmit power of all downlink DPCHs and PDSCHs of this radio link. When the TPC command is judged as “down”, the transmission power may be reduced by one step, whereas if judged as “up”, the transmission power may be raised by one step. 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 of the complex QPSK symbols of a single DPCH before spreading.

The total downlink transmission power at the 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 would exceed this limit, then the transmission power of all downlink DPCHs is reduced by the amount 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.

4.2.3.3.1 Out of synchronisation handling

When the dedicated physical channel out of sync criteria based on the received burst quality is as given in the section 4.4.2 then the UE shall set the uplink TPC bit = „1„ . The CRC based criteria shall not be taken into account in TPC bit value setting.

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25.224	**CR**	**020r1**	Current Version:	3.2.0

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

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

Source:	TSG RAN WG1	**Date:**	22, May 2000
Subject:	Editorial modification of 25.224		
Work item:	TS 25.224		

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification	X		Release 99	X
					Release 00	

Reason for change:	The number and the title of the table referenced in section 4.4.1 is incorrect.
Clauses affected:	Abbreviations, 4.4.1.

Other specs affected:	Other 3G core specifications		→ List of CRs:	
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
	BSS test specifications		→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

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3 Abbreviations

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

BCCH	Broadcast Control Channel
BCH	Broadcast Channel
CCTrCH	Coded Composite Transport Channel
DCA	Dynamic Channel Allocation
DPCH	Dedicated Physical Channel
DTX	Discontinous Transmission
FACH	Forward Access Channel
NRT	Non-Real Time
ODMA	Opportunity Division Multiple Access
ORACH	ODMA Random Access Channel
P-CCPCH	Primary Common Control Physical Channel
PRACH	Physical Random Access Channel
RACH	Random Access Channel
RT	Real Time
RU	Resource Unit
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 Physical layer procedures (TDD)

4.1 General

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.
Step size		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

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

After the synchronisation between UTRAN and UE is established, the UE transits into open-loop transmitter power control (TPC).
The transmitter power of UE shall be calculated by the following equation:

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

where

P_{UE} : Transmitter power level in dBm,

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

L_0: Long term average of path loss in dB

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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 physical channel that provides the beacon function, see [8]. α is calculated at the UE. An example for calculating α as a function of the time delay is given in Annex 1.

SIR_{TARGET}: Target SNR 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 $L_{P\text{-}CCPCH}$ 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.

4.2.2.3.1 Out of synchronisation handling

UE shall shut off the uplink transmission if the following criteria is fulfilled:

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- If the UE detect the beacon channel reception level [10 dBm] above the handover triggering level, then the UE uses [320] ms estimation period for the burst quality evaluation.

UE shall resume the uplink transmission if the follwowing criteria is fulfilled:

- The UE estimates the burst reception quality over the last [160] ms period to be better than a threshold Q_{in}. This criterion is always fulfilled during the first [160] ms of the dedicated channel's existence. Q_{in} is defined implicitly by the relevant tests in TS 25.102.

4.2.3 Downlink Control

4.2.3.1 P-CCPCH, PICH

The Primary CCPCH transmit power is set by higher layer signalling and can be changed based on network determination on a slow basis. The reference transmit power of the P-CCPCH is signalled on the BCH. The PICH is transmitted with the same power as the P-CCPCH.

4.2.3.2 S-CCPCH

The relative transmit power of the Secondary CCPCH compared to the P-CCPCH transmit power is set by higher layer signalling.

4.2.3.3 Dedicated Physical Channel

The initial transmission power of the downlink Dedicated Physical Channel is set by the network. After the initial transmission, the UTRAN transits into SIR-based inner loop power control.
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”.
As a response to the received TPC command, UTRAN may adjust the transmit power of all downlink DPCHs of this radio link. When the TPC command is judged as “down”, the transmission power may be reduced by one step, whereas if judged as “up”, the transmission power may be raised by one step. The transmission power of one DPCH 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 of the complex QPSK symbols of a single DPCH before spreading.

The total downlink transmission power at the 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 would exceed this limit, then the transmission power of all downlink DPCHs is reduced by the amount 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.

4.2.3.3.1 Out of synchronisation handling

When the dedicated physical channel out of sync criteria based on the received burst quality is as given in the section 4.4.2 then the UE shall set the uplink TPC bit = „1„ . The CRC based criteria shall not be taken into account in TPC bit value setting.

4.3 Timing Advance

UTRAN may adjust the UE transmission timing with timing advance. The initial value for timing advance will be determined in the UTRAN by measurement of the timing of the PRACH. The required timing advance will be represented as an 6 bit number (0-63) being the multiple of 4 chips which is nearest to the required timing advance.
When Timing Advance is used the UTRAN will continuously measure the timing of a transmission from the UE and send the necessary timing advance value. On receipt of this value the UE shall adjust the timing of its transmissions accordingly in steps of ±4chips.
The transmission of TA values is done by means of higher layer messages. Upon receiving the TA command the UE shall adjust its transmission timing according to the timing advance command at the beginning of the next frame that fulfils the SFN Mod20 = 0 criteria and which does not occur sooner than 10 frames after the TTI period for the DCCH carrying the timing advance command ended.
When TDD to TDD handover takes place the UE shall transmit in the new cell with timing advance TA adjusted by the relative timing difference Δt between the new and the old cell:

$$TA_{new} = TA_{old} + 2\Delta t$$

4.3.1 Timing advance with UL Synchronization

If UL Synchronization is used, the timing advance is sub-chip granular and with high accuracy in order to enable synchronous CDMA in the UL. The required timing advance will be represented as a multiple of 1/4 chips.
The UTRAN will continuously measure the timing of a transmission from the UE and send the necessary timing advance value. On receipt of this value the UE will adjust the timing of its transmissions accordingly in steps of ±1/4 chips.
Support of UL synchronisation is optional for the UE.

4.4 Synchronisation and Cell Search Procedures

4.4.1 Cell Search

During the initial cell search, the UE searches for a cell. It then determines the midamble, the downlink scrambling code and frame synchronisation of that cell. The initial cell search uses the Synchronisation Channel (SCH) described in [8]. The generation of synchronisation codes is described in [10].

This initial cell search is carried out in three steps:

Step 1: Slot synchronisation

During the first step of the initial cell search procedure the UE uses the primary synchronisation code c_p to acquire slot synchronisation to the strongest cell. Furthermore, frame synchronisation with the uncertainty of 1 out of 2 is obtained in this step. A single matched filter (or any similar device) is used for this purpose, that is matched to the primary synchronisation code which is common to all cells.

Step 2: Frame synchronisation and code-group identification

During the second step of the initial cell search procedure, the UE uses the modulated Secondary Synchronisation Codes to find frame synchronisation and identify one out of 32 code groups. Each code group is linked to a specific t_{Offset}, thus to a specific frame timing, and is containing 4 specific scrambling codes. Each scrambling code is associated with a specific short and long basic midamble code.

In Case 2 it is required to detect the position of the next synchronization slots. To detect the position of the next synchronization slots, the primary synchronization code is correlated with the received signal at offsets of 7 and 8 time slots from the position of the primary code that was detected in Step 1.

Then, the received signal at the positions of the synchronization codes is correlated with the primary synchronization Code C_p and the secondary synchronization codes $\{C_0,\ldots,C_{15}\}$. Note that the correlations can be performed coherently over M time slots, where at each slot a phase correction is provided by the correlation with the primary code. The minimal number of time slots is M=1, and the performance improves with increasing M.

Step 3: Scrambling code identification

During the third and last step of the initial cell-search procedure, the UE determines the exact basic midamble code and the accompanying scrambling code used by the found cell. They are identified through correlation over the P-CCPCH with all four midambles of the code group identified in the second step . Thus the third step is a one out of four decision. This step is taking into account that the P-CCPCH containing the BCH is transmitted using the first channelization code ($c_{Q=16}^{(h=1)}$ in [10]) and using the first midamble $\mathbf{m}^{(1)}$ (derived from basic midamble code $\mathbf{m}_P$ in [8]). Thus P-CCPCH code and midamble can be immediately derived when knowing scrambling code and basic midamble code. Note that the cell parameters change from frame to frame, cf. ‘Table ~~8~~ 7 Alignment of cell parameter cycling and ~~system frame number~~ SFN’ in [10].

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Document *R1-00-0652*

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or for SMG, use the format P-99-xxx

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25.224	**CR**	**021**	Current Version:	3.2.0

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

For submission to:	TSG RAN#8	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

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

Source: TSG RAN WG1 **Date:** 2000-05-12

Subject: Clarifications on TxDiversity for UTRA TDD

Work item:

Category:				**Release:**		
	F	Correction			Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification	X		Release 99	X
					Release 00	

Reason for change:

- Clarification on optional usage of TxDiversity in UTRAN
- Clarification on mandatory support of TxDiversity in UE
- Shift of exemplary Weight Factor Determination in informative annex

Clauses affected: 4.6, Annex

Other specs affected:			
	Other 3G core specifications		→ List of CRs:
	Other GSM core specifications		→ List of CRs:
	MS test specifications		→ List of CRs:
	BSS test specifications		→ List of CRs:
	O&M specifications		→ List of CRs:

Other comments:

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4.6 Downlink Transmit Diversity

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

4.6.1 Transmit Diversity for DPCH

The transmitter structure to support transmit diversity for 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.

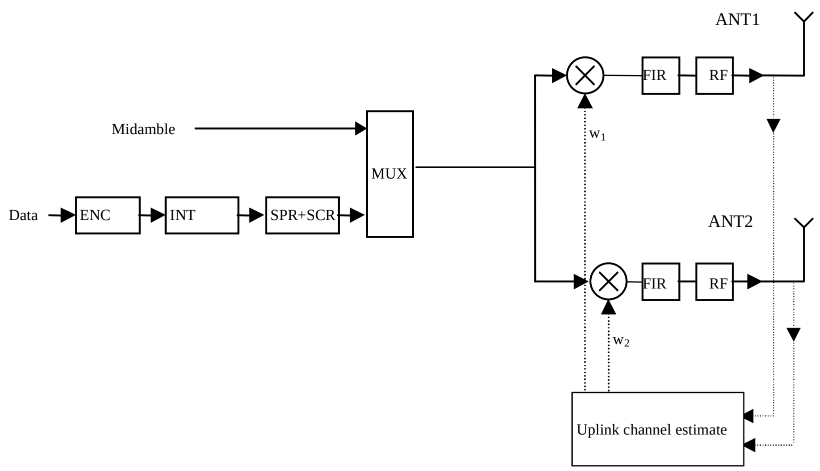

Figure 1: Downlink transmitter structure to support Transmit Diversity for DPCH transmission (UTRAN Access Point)

~~4.6.1.1 Determination of Weight Information~~

~~Selective Transmit Diversity (STD) and Transmit Adaptive Antennas (TxAA) are examples of transmit diversity schemes for dedicated physical channels.~~

~~4.6.1.1.1 STD Weights~~

~~The weight vector will take only two values depending on the signal strength received by each antenna in the uplink slot. For each user, the antenna receiving the highest power will be selected (i.e. the corresponding weight will be set to 1).~~

~~Table 2: STD weights for two TX antennas~~

	~~W_1~~	~~W_2~~
~~Antenna 1 receiving highest power~~	~~1~~	~~0~~
~~Antenna 2 receiving highest power~~	~~0~~	~~1~~

~~4.6.1.1.2 TxAA Weights~~

~~In a generic sense, the weight vector to be applied at the transmitter is the $\underline{w}$ that maximises:~~

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

~~where~~

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

~~and where the column vector h_i represents the estimated uplink channel impulse response for the i'th transmission antenna, of length equal to the length of the channel impulse response.~~

4.6.2 Transmit Diversity for SCH

Time Switched Transmit Diversity (TSTD) can be employed as transmit diversity scheme~~s~~ 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 e~~E~~xample for the antenna switching pattern is shown in figure 3.

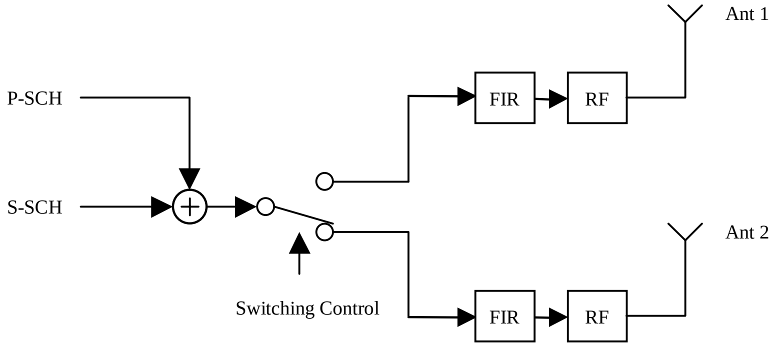

Figure 2: Downlink transmitter structure to support Transmit Diversity for SCH transmission (UTRAN Access Point)

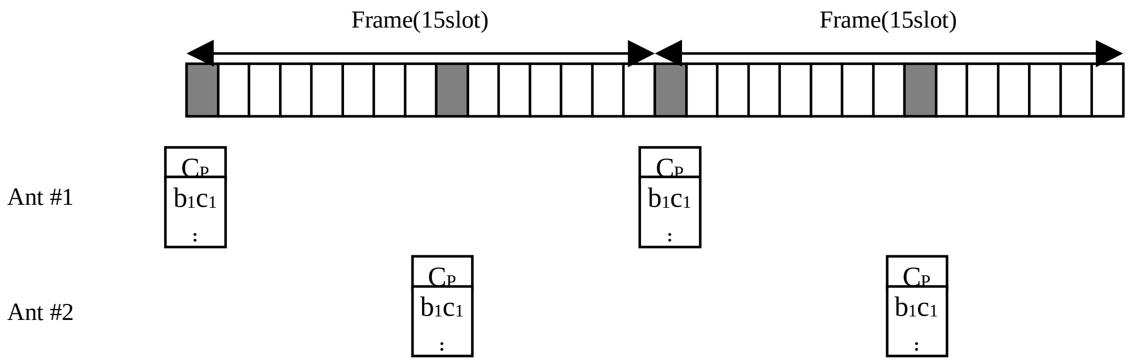

Figure 3: Antenna Switching Pattern (Case 2)

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.

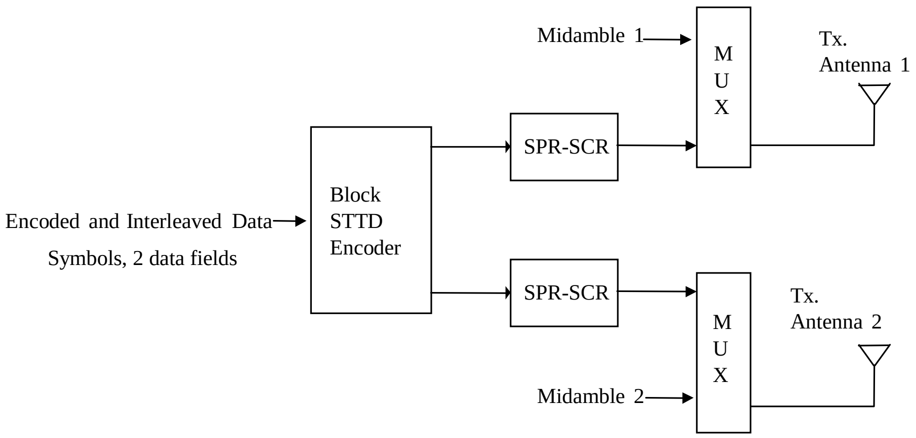

Figure 4: Block Diagram of the transmitter (STTD)

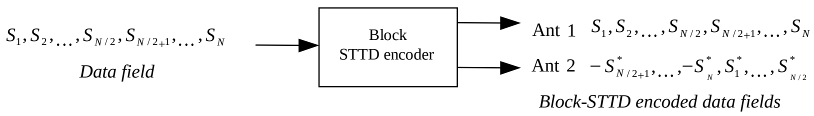

Figure 5: Block Diagram of Block STTD encoder. The symbols S_i are QPSK. N is the length of the block to be encoded

Annex B (informative): Determination of Weight Information

Selective Transmit Diversity (STD) and Transmit Adaptive Antennas (TxAA) are examples of transmit diversity schemes for dedicated physical channels.

B.1 STD Weights

The weight vector will take only two values depending on the signal strength received by each antenna in the uplink slot. For each user, the antenna receiving the highest power will be selected (i.e. the corresponding weight will be set to 1).

Table 2: STD weights for two TX antennas

	W_1	W_2
Antenna 1 receiving highest power	1	0
Antenna 2 receiving highest power	0	1

B.2 TxAA Weights

In a generic sense, the weight vector to be applied at the transmitter is the *w* that maximises:

$$P = w^H H^H H w \quad (2)$$

where

$H=[h_1\ h_2]$ and $w = [\ w_1, w_2\ ]^T$

and where the column vector h_i represents the estimated uplink channel impulse response for the i'th transmission antenna, of length equal to the length of the channel impulse response.

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25.224 CR 022r1 Current Version: V3.2.0

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

For submission to: TSG RAN #8
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for approval	X	strategic		*(for SMG use only)*
for information		non-strategic		

Proposed change affects: *(at least one should be marked with an X)*

(U)SIM	ME	UTRAN / Radio	Core Network
	X	X	

Source: TSG RAN WG1 **Date:** 05.05.1999

Subject: Introduction of the TDD DSCH detection procedure in TS 25.224

Work item: TS25.224

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

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: No such procedure currently exists for DSCH detection with UTRA TDD and it is seen beneficial to have it as it clarifies the means for the UE to determine the presence of an shared channel and hence enhances the power saving features. Also with TFCI based signalling the timing relationship with DCH and DSCH is currently missing.

Clauses affected: New section 4.8 created

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

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4.8 DSCH procedure

The physical downlink shared channel procedure described below shall be applied by the UE when the physical layer signalling either with the midamble based signalling or TFCI based signalling is used to indicate for the UE the need for PDSCH detection. There is also a third alternative to indicate to the UE the need for the PDSCH detection and this is done by means of higher layer signalling, already described in [8].

4.8.1 DSCH procedure with TFCI indication

When the UE has been allocated by higher layers to receive data on DSCH using the TFCI, the UE shall decode the PDSCH in the following cases:

- In case of a standalone PDSCH the TFCI is located on the PDSCH itself, then the UE shall decode the TFCI and based on which data rate was indicated by the TFCI, the decoding shall be performed. The UE shall decode PDSCH only if the TFCI word decode corresponds to the TFC part of the TFCS given to the UE by higher layers.
- In case that the TFCI is located on the DCH, the UE shall decode the PDSCH frame or frames if the TFCI on the DCH indicates the need for PDSCH reception. Upon reception of the DCH time slot or time slots, the PDSCH slot (or first PDSCH slot) shall start *SFN n+2* after the DCH frame containing the TFCI, where n indicates the SFN on which the DCH is received. In the case that the TFCI is repeated over several frames, the PDSCH slot shall start *SFN n+2* after the frame having the DCH slot which contains the last part of the repeated TFCI.

4.8.2 DSCH procedure with midamble indication

When the UE has been allocated by higher layers to receive PDSCH based on the midamble used on the PDSCH (midamble based signalling described in [8]), the UE shall operate as follows:

- The UE shall test the midamble it received and if the midamble received was the same as indicated by higher layers to correspond to PDSCH reception, the UE shall detect the PDSCH data according to the TF given by the higher layers for the UE.
- In case of multiple time slot allocation for the DSCH indicated to be part of the TF for the UE, the UE shall receive all timeslots if the midamble of the first timeslot of PDSCH was the midamble indicated to the UE by higher layers.
- In case the standalone PDSCH (no associated DCH) contains the TFCI the UE shall detect the TF indicated by the TFCI on PDSCH.

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25.224 CR 023 Current Version: 3.2.0

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

For submission to: TSG RAN#8
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for approval	X	strategic		*(for SMG use only)*
for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG RAN WG1 **Date:** 2000-05-24

Subject: Downlink power control on timeslot basis

Work item:

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

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

Reason for change: The node B may use the ISCP measurements by the UE for power offsets on a timeslot basis

Clauses affected: 4.2.3

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

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4.2.3 Downlink Control

4.2.3.1 P-CCPCH, PICH

The Primary CCPCH transmit power is set by higher layer signalling and can be changed based on network determination on a slow basis. The reference transmit power of the P-CCPCH is signalled on the BCH. The PICH is transmitted with the same power as the P-CCPCH.

4.2.3.2 S-CCPCH

The relative transmit power of the Secondary CCPCH compared to the P-CCPCH transmit power is set by higher layer signalling.

4.2.3.3 Dedicated Physical Channel

The initial transmission power of the downlink Dedicated Physical Channel is set by the network. After the initial transmission, the UTRAN transits into SIR-based inner loop power control.

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".

As a response to the received TPC command, UTRAN may adjust the transmit power of all downlink DPCHs of this radio link. When the TPC command is judged as "down", the transmission power may be reduced by one step, whereas if judged as "up", the transmission power may be raised by 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 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 of the complex QPSK symbols of a single DPCH before spreading.

The total downlink transmission power at the 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 would exceed this limit, then the transmission power of all downlink DPCHs is reduced by the amount 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.

4.2.3.3.1 Out of synchronisation handling

When the dedicated physical channel out of sync criteria based on the received burst quality is as given in the section 4.4.2 then the UE shall set the uplink TPC bit = „1„ . The CRC based criteria shall not be taken into account in TPC bit value setting.