TSG-RAN Meeting #7 ***RP-000070***
Madrid, Spain, 13 – 15 March 2000

Title: **Agreed CRs to TS 25.224**

Source: **TSG-RAN WG1**

Agenda item: **6.1.3**

No.	Doc #	Spec	CR	Rev	Subject	Cat	Versio	Versio
1	R1-000135	25.224	003	2	Cycling of cell parameters	C	3.1.1	3.2.0
2	R1-000291	25.224	007	2	Clarifications on the UL synchronisation and	D	3.1.1	3.2.0
3	R1-000068	25.224	008	-	Modification of SIR threshold on setting TPC	D	3.1.1	3.2.0
4	R1-000417	25.224	009	1	New section describing the random access	F	3.1.1	3.2.0
5	R1-000220	25.224	011	-	Removal of Synchronisation Case 3 in TDD	F	3.1.1	3.2.0
6	R1-000380	25.224	012	1	Clarifications on power control procedures	D	3.1.1	3.2.0
7	R1-000228	25.224	013	-	Signal Point Constellation	D	3.1.1	3.2.0
8	R1-000389	25.224	014	2	Out-of-sync handling for UTRA TDD	B	3.1.1	3.2.0
9	R1-000440	25.224	015	-	Removal of ODMA from the TDD specifications	D	3.1.1	3.2.0

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

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25.224 CR 003r2 Current Version: V3.1.0

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

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

Source: TSG RAN WG1 **Date:** 13 Jan 2000

Subject: Cycling of cell parameters

Work item: TS25.224

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	X		Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change: Improvement in performance by increased diversity and reduction of false paths.

Clauses affected: 4.4.1

Other specs affected:				
	Other 3G core specifications	X	→ List of CRs:	25.221-CR003r2, 25.223-CR002r3
	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:

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 Physical Synchronisation Channel (PSCH) 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 Cases 2 and 3 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 ($a_{Q=16}^{(h=1)}$ 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 Alignment of cell parameter cycling and system frame number' in [10].

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

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25.224 CR 007r2 Current Version: V3.1.0

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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:**	23.02.2000
Subject:	Clarifications on the UL synchronisation and Timing advance.		
Work item:	TS25.224		

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

			Release:	
F	Correction		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	X	Release 99	X
			Release 00	

Reason for change: Clarifications to the current description on the use of the Timing Advance are needed.

Clauses affected: 4.3

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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4.3 Timing Advance

4.3.1 Without UL Synchronization

UTRAN may adjust the UE transmission timing with timing advance. The timing of transmissions from the UE is adjusted according to timing advance values received from the UTRAN. 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 68 bit number (0-63255) being the multiple of 4 chips which is nearest to the required timing advance. The maximum allowed value may be limited by the operator to a value lower than 255, if required or the function may be disabled. A UE cannot operate beyond the range set by the maximum value of timing advance.

When Timing Advance is used tThe 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 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:

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

4.3.12 Timing advance wWith UL Synchronization

With 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 1/48 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 ±1/48 chips. The transmission of TA values is ffs.

Support of UL synchronisation is optional for the UE.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

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25.224	**CR**	**008**	Current Version:	3.1.0

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

For submission to:	WG1 # 10	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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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:	11 January, 2000
Subject:	Modification of SIR threshold on setting TPC
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:	Correction of error in 25.224.
Clauses affected:	4.2.3.2

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 Common Physical Channel

The Primary CCPCH transmit power can be changed based on network determination on a slow basis. The reference transmit power of P-CCPCH is signaled on the BCH on a periodic basis.

4.2.3.2 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 TPC as similar to the FDD mode

The measurement of received SIR shall be carried out periodically at the UE. When the measured value is higher than or equal to the target SIR value, TPC bit = „0„. When this is lower than the target SIR value, TPC bit = „1„. At the UTRAN, soft decision on the TPC bits is performed, and when it is judged as „0„, the transmission power may be reduced by one step, whereas if judged as „1„, the transmission power may be raised by one step.

When the TPC bit cannot be received due to out-of-synchronisation, the transmission power value shall be kept at a constant value. When SIR measurement cannot be performed due to out-of-synchronisation, the TPC bit shall always be = „1„ during the period of being out-of-synchronisation.

A higher layer outer loop adjusts the target SIR.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

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25.224	**CR**	**009rev1**	Current Version:	3.1.0

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

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

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:** 2000-03-02

Subject: New section describing the random access procedure

Work item:

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:
25.214 chapter 6 describes the random access procedure for FDD.
Such a description is missing for TDD in 25.224.

Clauses affected: 4.8 (new text)

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 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 broadcasted on the BCH in each cell. Parameters for common physical channel uplink outer loop power control are also broadcasted on the BCH in each cell. The UE needs to decode this information prior to transmission on the RACH.

4.8.1 Physical random access procedure

The physical random access procedure described in this section is initiated upon request of a PHY-Data-REQ primitive from the MAC sublayer (cf. TS 25.321 and TS 25.303).
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 :

- The available PRACH sub-channels for each Access Service Class (ASC)
- The timeslot, spreading factor, channelisation code, midamble, repetition period and offset for each PRACH sub-channel. (There is a 1:1 mapping between spreading code and midamble as defined by RRC)
- The set of Transport Format parameters.
- The set of parameters for common physical channel uplink outer loop power control

Note that 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 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.
3. Randomly select a spreading code 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. The midamble is derived from the selected spreading code.
4. Set the PRACH message transmission power level according to the specification for common physical channels in uplink (see Sect. 4.2.2.1).
5. Transmit the random access message.

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Madrid, Spain, 13-15 March 2000

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25.224 CR 011 Current Version: 3.1.0

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

For submission to: RAN#7
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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:** 2000-02-21

Subject: Removal of Synchronisation Case 3 in TDD

Work item:

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: Performance of SCH acquisition is too low with synchronisation case 3.

Clauses affected: 3, 4.4

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	CR014-221, CR005-223
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
~~PSCH~~	~~Primary Synchronisation Channel~~
RACH	Random Access Channel
RT	Real Time
RU	Resource Unit
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
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

4.4 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 ~~Physical~~ Synchronisation Channel (~~P~~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~~s~~ 2 ~~and 3~~ 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 ($a_{Q=16}^{(h=1)}$ 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.

3GPP TSG RAN Meeting #7
Madrid, Spain, 13-15 March 2000

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25.224	**CR**	**012rev1**	Current Version:	3.1.0

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

For submission to:	RAN#7	for approval	X	strategic		*(for SMG use only)*
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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:**	2000-03-01
Subject:	Clarifications on power control procedures		
Work item:			

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:	Some parts of the power control procedures have to be refined and aligned with higher layer descriptions
Clauses affected:	4.2

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 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.

4.2.2.21 PRACHCommon Physical Channel

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

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

$$P_{PRACH} = L_{P-CCPCH} + I_{BTS} + \text{Constant value}$$

where

P_{PRACH} : Transmitter power level in dBm,

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

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

Constant value: This value shall be set by higher Layer (operator matter).

4.2.2.32 DPCHDedicated Physical Channel, PUSCH

The initial transmission power is decided in a similar manner as PRACH. 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:

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

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.

4.2.3 Downlink Control

4.2.3.1 P-CCPCH, PICHCommon Physical Channel

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. on a periodic basis.

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..

4.2.3.32 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.TPC as similar to the FDD mode

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 commandbit = "down""0". When this is lower than or equal to than the target SIR value, TPC commandbit = "up""1". At the UTRAN, soft decision on the TPC bits is performed, and when it is judged as "0", the transmission power may be reduced by one step, whereas if judged as "1", the transmission power may be raised by one step.

As a response to the received TPC commands, 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

~~When the TPC bit cannot be received due to out-of-synchronisation, the transmission power value shall be kept at a constant value. When SIR measurement cannot be performed due to out-of-synchronisation, the TPC bit shall always be = „1„ during the period of being out-of-synchronisation.~~

A higher layer outer loop adjusts the target SIR.

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Document R1-00-0228
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25.224	**CR**	**013**		Current Version:	3.1.0

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

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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:**	2000-02-25
Subject:	Signal Point Constellation		
Work item:			

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:	Only editorial modification, corresponds to modification in TS25.223 CR 006r1 regarding Signal Point Constellation
Clauses affected:	4.4.1

Other specs affected:	Other 3G core specifications	X	→ List of CRs:	25.223 CR006r1, 25.221 CR015r1
	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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4.4.1 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 Physical Synchronisation Channel (PSCH) 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 Cases 2 and 3 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 ($a_{Q=16}^{(h=1)}$ $c_{Q=16}^{(h=1)}$ 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.

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25.224 CR 014r2 Current Version: V3.1.0

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

For submission to:	TSG RAN #7	For approval	X	strategic	(for SMG use only)
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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:** 01.03.2000

Subject: Out-of-sync handling for UTRA TDD

Work item: TS25.224

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	X	
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: Completion of the out-of-sync work item for release 99 for UTRA TDD.

Clauses affected: 4.2.2, 4.2.3, 4.4, 4.6

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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<--------- double-click here for help and instructions on how to create a CR.

4.2.2 Uplink Control

4.2.2.1 Common Physical Channel

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

$$P_{PRACH} = L_{P\text{-}CCPCH} + I_{BTS} + \text{Constant value}$$

where

P_{PRACH} : Transmitter power level in dBm,

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

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

Constant value: This value shall be set by higher Layer (operator matter).

4.2.2.2 Dedicated Physical Channel

The initial transmission power is decided in a similar manner as PRACH. 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).

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.

4.2.2.2.1 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 Common Physical Channel

The Primary CCPCH transmit power can be changed based on network determination on a slow basis. The reference transmit power of P-CCPCH is signaled on the BCH on a periodic basis.

4.2.3.2 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 TPC as similar to the FDD mode

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 bit = „0„. When this is lower than the target SIR value, TPC bit = „1„. At the UTRAN, soft decision on the TPC bits is performed, and when it is judged as „0„, the transmission power may be reduced by one step, whereas if judged as „1„, the transmission power may be raised by one step.

When the TPC bit cannot be received due to out-of-synchronisation, the transmission power value shall be kept at a constant value. When SIR measurement cannot be performed due to out-of-synchronisation, the TPC bit shall always be = „1„ during the period of being out-of-synchronisation.

A higher layer outer loop adjusts the target SIR.

4.2.3.2.1 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.

4.4 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 Physical Synchronisation Channel (PSCH) 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 Cases 2 and 3 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 ($a_{Q=16}^{(h=1)}$ 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.

4.4.2 Dedicated channel synchronisation

4.4.2.1 Synchronisation primitives

4.4.2.1.1 General

For the dedicated channels, synchronisation primitives are used to indicate the synchronisation status of radio links, both in uplink and downlink. The definition of the primitives is given in the following sub-clauses.

4.4.2.1.2 Downlink synchronisation primitives

Layer 1 in the UE shall every radio frame check synchronisation status of the downlink dedicated channels. Synchronisation status is indicated to higher layers, using the CPHY-Sync-IND or CPHY-Out-of-Sync-IND primitives.

Out-of-sync shall be reported using the CPHY-Out-of-Sync-IND primitive if either of 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, the UE uses [320] ms estimation period for the burst quality evaluation.

- The last [16] transport blocks, as observed on all TrCHs using CRC, are received with incorrect CRC. In addition, over the last [160] ms, no transport block has been received with correct CRC. In case the beacon channel reception criteria is fulfilled the values are [32] transport blocks and [320] ms respectively.

In-sync shall be reported using the CPHY-Sync-IND primitive if both of the following criteria are 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 25.104.

- At least one transport block, as observed on all TrCHs using CRC, is received with correct CRC. If there is no TrCH using CRC, this criterion is always fullfiled.

How the primitives are used by higher layers is described in TS 25.331.

4.4.2.1.3 Uplink synchronisation primitives

Layer 1 in the Node B shall every radio frame check synchronisation status of the radio link. Synchronisation status is indicated to the RL Failure/Restored triggering function using either the CPHY-Sync-IND or CPHY-Out-of-Sync-IND primitive.

The exact criteria for indicating in-sync/out-of-sync is not subject to specification, but could e.g. be based on received burst quality or CRC checks. One example would be to have the same criteria as for the downlink synchronisation status primitives.

4.4.2.2 Radio link monitoring

4.4.2.2.1 Downlink radio link failure

The downlink radio links are monitored by the UE, to trigger radio link failure procedures. The downlink radio link failure criteria is specified in TS 25.331, and is based on the synchronisation status primitives CPHY-Sync-IND and CPHY-Out-of-Sync-IND, indicating in-sync and out-of-sync respectively.

4.4.2.2.2 Uplink radio link failure/restore

The uplink radio links are monitored by the Node B, to trigger radio link failure/restore procedures. Once the radio links have been established, they will be in the in-sync or out-of-sync states as shown in figure 1 in sub-clause 4.3.2.1. Transitions between those two states are described below.

The uplink radio link failure/restore criteria is based on the synchronisation status primitives CPHY-Sync-IND and CPHY-Out-of-Sync-IND, indicating in-sync and out-of-sync respectively.

When the radio links are in the in-sync state, Node B shall start timer T_RLFAILURE after receiving N_OUTSYNC_IND consecutive out-of-sync indications. Node B shall stop and reset timer T_RLFAILURE upon receiving successive N_INSYNC_IND in-sync indications. If T_RLFAILURE expires, Node B shall trigger the RL Failure procedure and indicate which radio links are out-of-sync. When the RL Failure procedure is triggered, the radio links' state changes to the out-of-sync state.

When the radio links are in the out-of-sync state, after receiving N_INSYNC_IND successive in-sync indications Node B shall trigger the RL Restore procedure and indicate which radio links have re-established synchronisation. When the RL Restore procedure is triggered, the radio links' state changes to the in-sync state.

The specific parameter settings (values of T_RLFAILURE, N_OUTSYNC_IND, and N_INSYNC_IND) are configurable, see TS 25.433.

4.5 ODMA Relay Probing

This section describes the probe-response procedure used by ODMA nodes to detect neighbours which may be used as relays during a call.

4.5.1 Initial Mode Probing

The initial mode probing procedure is activated by a UE when it is switched on and has no information about its surroundings. In this case the UE will synchronise with the ODMA Random Access Channel (ORACH) which is used by all UEs to receive and broadcast system routing control information and data. The UE begins a probing session by periodically broadcasting a probe packet on the ORACH. The broadcast probe includes the current neighbour list for the UE which will initially be empty. If a neighbouring UE, UE*a*, receives the broadcast packet it will register the UE as a neighbour and send an addressed response probe. The response probe is transmitted at random to avoid contention with other UEs and typically one response is sent for every *n* broadcast probes received from a particular UE.

The next time the UE transmits a broadcast probe the neighbour list will have one new entry, UE*a*, and an associated quality indicator (a weighted factor based on the received signal strength of the response probe). It is through this basic mechanism that each UE builds a neighbour list.

4.5.2 Idle Mode Probing

The Idle Mode Probing procedure is activated when the UE has synchronised with the ORACH but is not transmitting data. This procedure is the same as that described above after ORACH synchronisation.

The ODMA Idle Mode Probing procedure controls the rate of probing on the ORACH to reduce interference levels and regulate power consumption. The procedure is governed by a state machine, which consists of the following states: full probing, duty maintained probing, and relay prohibited. Each state defines the number of probing opportunities within one *N* multiframe, and a probing activity parameter *K* which is the ratio of probe transmission time to probe monitoring time.

Full probing

Full probing is the case where probing is allowed on every ORACH timeslot within an *N* multiframe. The UE_R will probe on the ORACH at a rate defined by the probing activity parameter *K*.

Duty Maintained probing

The duty maintained probing is the case where probing is allowed on *M* slots of an *N* multiframe. The UE_R will probe on the *M* ORACH slots in an *N* multiframe at a rate defined by the probing activity parameter *K*.

Relay Prohibited

In this mode the UE_R would cease all of its ODMA probing activities and will fall into standard TDD or FDD operation.

The probing activity levels for given state machines are illustrated in Figure 1 for a system with an ORACH for M slots per $N \times 16$ multiframe.

Note that the distribution of probing opportunities within a multiframe may not necessarily be consecutive and located at the beginning of a multiframe.

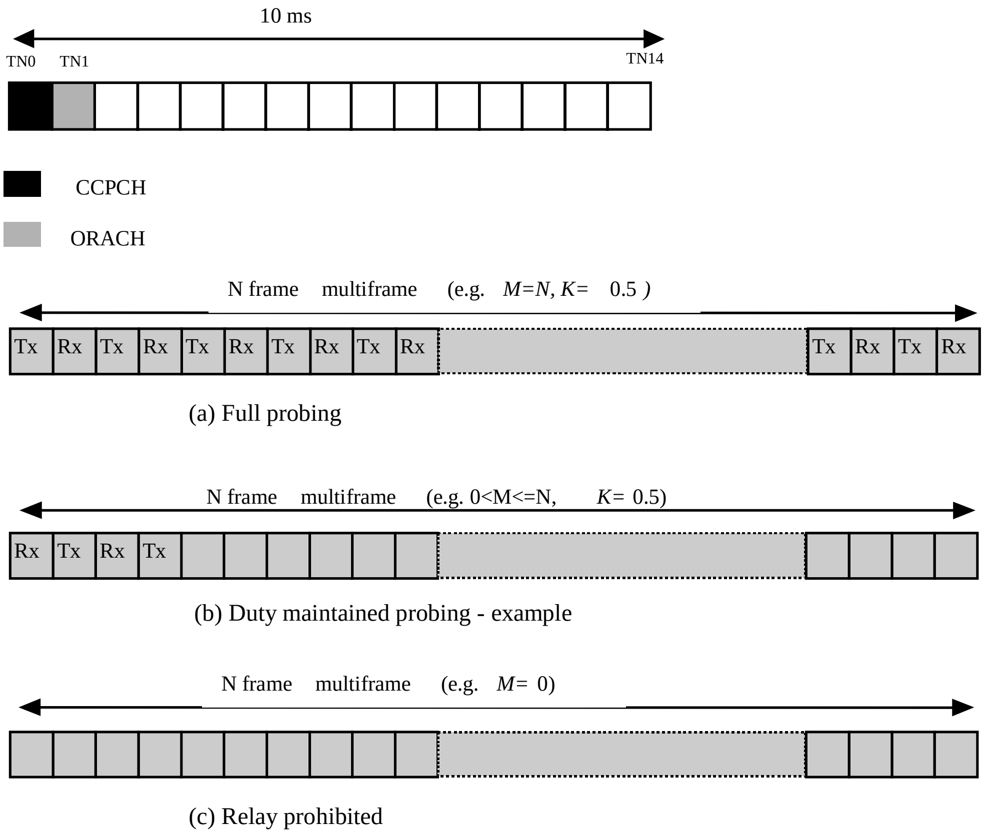

Figure 1: Probing state machines and mechanism

4.5.3 Active Mode Probing

The Active Mode Probing procedure is activated when the UE has synchronised with the ORACH and is transmitting data.

With ODMA, data may be relayed on either the ODMA Random Access Channel (ORACH) or the ODMA dedicated transport channel (ODCH), depending on the volume of data to be sent. When a UE has small amounts of data to send it may transmit an addressed probe response packet on the ORACH at an interval proportional to air interface modem rate, R_{CCH}, and is defined by *Probe_timer_1*. This interval also defines the broadcast probe interval, *Probe_timer_2*, which is typically five times longer than *Probe_timer_1*. Every time an UE transmits a response probe containing data on the ORACH, it may be received, but not acknowledged, by third party neighbour UEs, and provides an implicit indication of activity. In this instance broadcast probes are not necessary and *Probe_timer_2* is reset after every addressed probe transmission. Only when an UE has no data to send is it necessary to transmit a broadcast probe every *Probe_timer_2* seconds to register its active status with its neighbours.

In order to avoid overlapping packet transmissions the length of the packet may not exceed the probe timer interval, *Probe_timer_1*. The relationship between the different probe timers is illustrated in Figure 2.

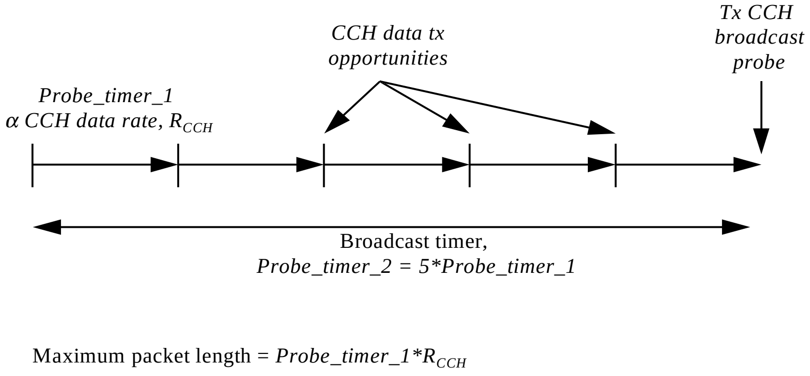

Figure 2: Probe timer relationships

4.6 Discontinuous transmission (DTX) of Radio Frames

Discontinuous transmission (DTX) is applied in up- and downlink when the total bit rate after transport channel multiplexing differs from the total channel bit rate of the allocated dedicated physical channels.

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.

When DTX is applied in the uplink and after a period of (N_OUTSYNC_IND / 2)-1 silent frames no data has to be transmitted, then a dummy burst should be generated and transmitted in the next possible frame.

This dummy burst should have the same slot format as the normal burst where DTX is used. The dummy burst is filled with an arbitrary bit pattern, contains a TFCI and TPC bits if inner loop PC is applied. The TFCI of the dummy burst should indicate that there is no data to be transmitted.

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25.224 CR 015 Current Version: V3.1.0

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

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Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form : 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:** 23.02.2000

Subject: Removal of ODMA from the TDD specifications

Work item: TS25.224

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: Removal of ODMA from the TDD specifications since it is not supported for R99

Clauses affected:

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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<--------- double-click here for help and instructions on how to create a CR.

4.5 ODMA Relay Probing

This section describes the probe-response procedure used by ODMA nodes to detect neighbours which may be used as relays during a call.

4.5.1 Initial Mode Probing

The initial mode probing procedure is activated by a UE when it is switched on and has no information about its surroundings. In this case the UE will synchronise with the ODMA Random Access Channel (ORACH) which is used by all UEs to receive and broadcast system routing control information and data. The UE begins a probing session by periodically broadcasting a probe packet on the ORACH. The broadcast probe includes the current neighbour list for the UE which will initially be empty. If a neighbouring UE, UE*a*, receives the broadcast packet it will register the UE as a neighbour and send an addressed response probe. The response probe is transmitted at random to avoid contention with other UEs and typically one response is sent for every *n* broadcast probes received from a particular UE.

The next time the UE transmits a broadcast probe the neighbour list will have one new entry, UE*a*, and an associated quality indicator (a weighted factor based on the received signal strength of the response probe). It is through this basic mechanism that each UE builds a neighbour list.

4.5.2 Idle Mode Probing

The Idle Mode Probing procedure is activated when the UE has synchronised with the ORACH but is not transmitting data. This procedure is the same as that described above after ORACH synchronisation.

The ODMA Idle Mode Probing procedure controls the rate of probing on the ORACH to reduce interference levels and regulate power consumption. The procedure is governed by a state machine, which consists of the following states: full probing, duty maintained probing, and relay prohibited. Each state defines the number of probing opportunities within one *N* multiframe, and a probing activity parameter *K* which is the ratio of probe transmission time to probe monitoring time.

Full probing

Full probing is the case where probing is allowed on every ORACH timeslot within an *N* multiframe. The UE_R will probe on the ORACH at a rate defined by the probing activity parameter *K*.

Duty Maintained probing

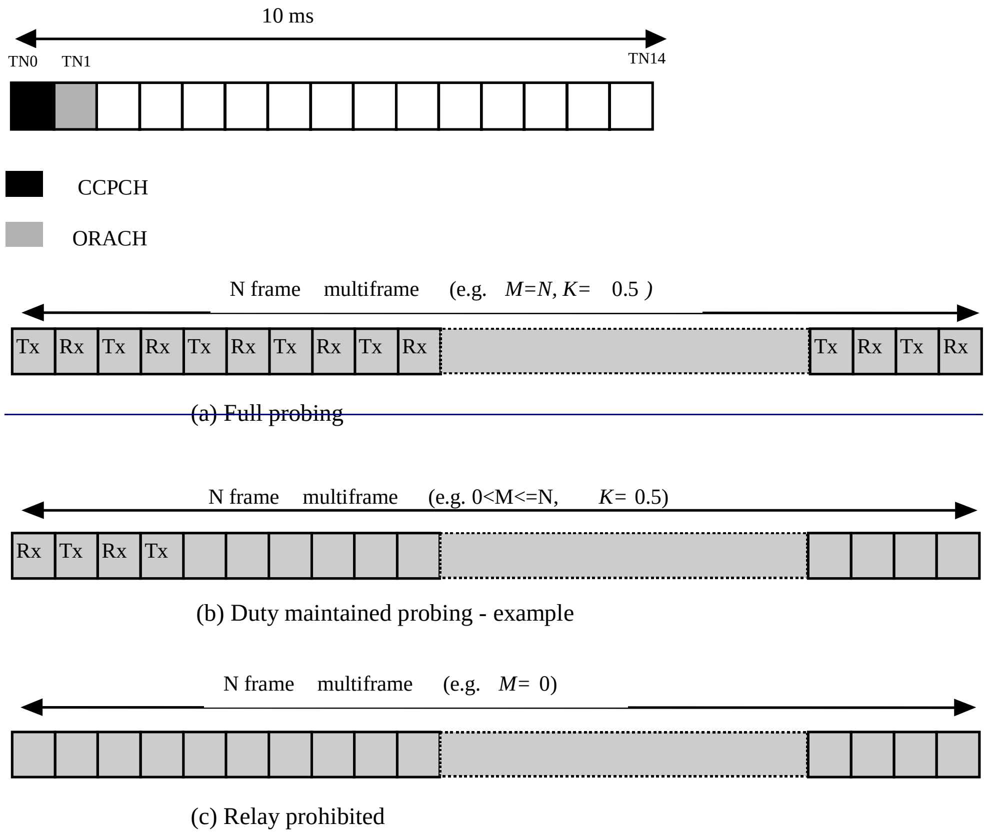
The duty maintained probing is the case where probing is allowed on *M* slots of an *N* multiframe. The UE_R will probe on the *M* ORACH slots in an *N* multiframe at a rate defined by the probing activity parameter *K*.

Relay Prohibited

In this mode the UE_R would cease all of its ODMA probing activities and will fall into standard TDD or FDD operation.

The probing activity levels for given state machines are illustrated in Figure 1 for a system with an ORACH for M slots per $N \times 16$ multiframe.

Note that the distribution of probing opportunities within a multiframe may not necessarily be consecutive and located at the beginning of a multiframe.



~~**Figure 1: Probing state machines and mechanism**~~

~~4.5.3 Active Mode Probing~~

~~The Active Mode Probing procedure is activated when the UE has synchronised with the ORACH and is transmitting data.~~

~~With ODMA, data may be relayed on either the ODMA Random Access Channel (ORACH) or the ODMA dedicated transport channel (ODCH), depending on the volume of data to be sent. When a UE has small amounts of data to send it may transmit an addressed probe response packet on the ORACH at an interval proportional to air interface modem rate, R_{CCH}, and is defined by *Probe_timer_1*. This interval also defines the broadcast probe interval, *Probe_timer_2*, which is typically five times longer than *Probe_timer_1*. Every time an UE transmits a response probe containing data on the ORACH, it may be received, but not acknowledged, by third party neighbour UEs, and provides an implicit indication of activity. In this instance broadcast probes are not necessary and *Probe_timer_2* is reset after every addressed probe transmission. Only when an UE has no data to send is it necessary to transmit a broadcast probe every *Probe_timer_2* seconds to register its active status with its neighbours.~~

~~In order to avoid overlapping packet transmissions the length of the packet may not exceed the probe timer interval, *Probe_timer_1*. The relationship between the different probe timers is illustrated in Figure 2.~~

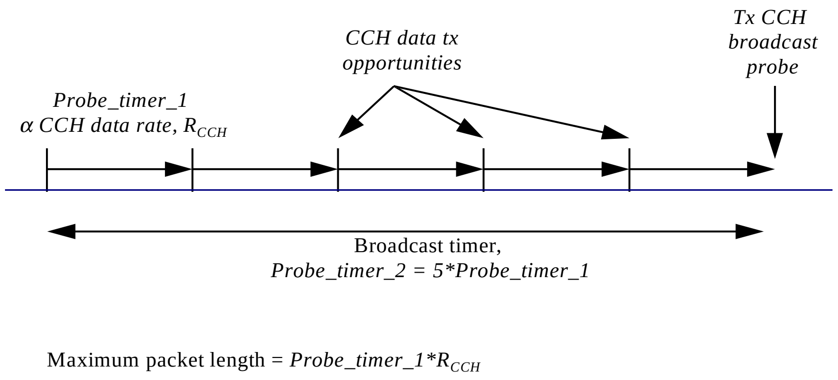


Figure 2: Probe timer relationships

4.5~~6~~ Discontinuous transmission (DTX) of Radio Frames

Discontinuous transmission (DTX) is applied in up- and downlink when the total bit rate after transport channel multiplexing differs from the total channel bit rate of the allocated dedicated physical channels.

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.

4.6~~7~~ Downlink Transmit Diversity

4.6~~7~~.1 Transmit Diversity for DPCH

The transmitter structure to support transmit diversity for DPCH transmission is shown in Figure 3. Channel coding, interleaving and spreading are done as in non-diversity mode. The spread complex valued signal is fed to both TX antenna branches, and weighted with antenna specific weight factors w_1 and w_2. The weight factors are complex valued signals (i.e., $w_i = a_i + jb_i$), in general. These weight factors are calculated on a per slot and per user basis.

The weight factors are determined by the UTRAN.

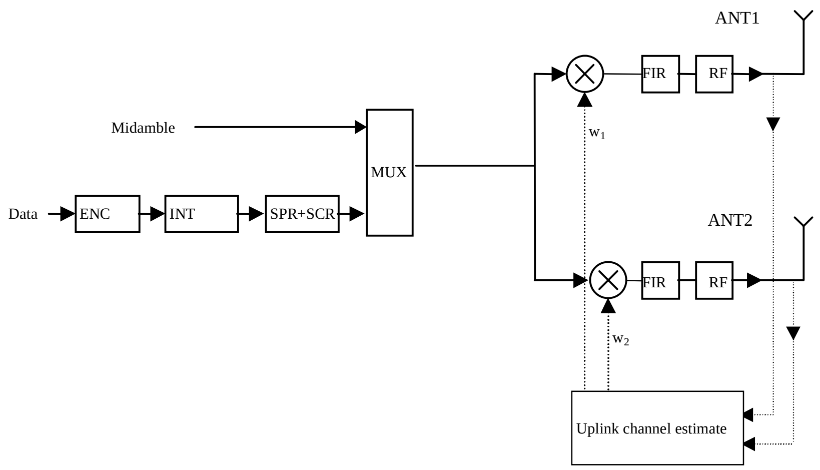


Figure 1~~3~~. Downlink transmitter structure to support Transmit Diversity for DPCH transmission (UTRAN Access Point)

4.6~~7~~.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~~7~~.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 1: 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~~7~~.1.1.2 TxAA Weights

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

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

where

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

and where the column vector $\underline{h}_i$ 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~~7~~.2 Transmit Diversity for SCH

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

4.6~~7~~.2.1 SCH Transmission Scheme

The transmitter structure to support transmit diversity for SCH transmission is shown in Figure 4. P-SCH and S-SCH are transmitted from antenna 1 and antenna 2 alternatively. Example for antenna switching pattern is shown in Figure 5.

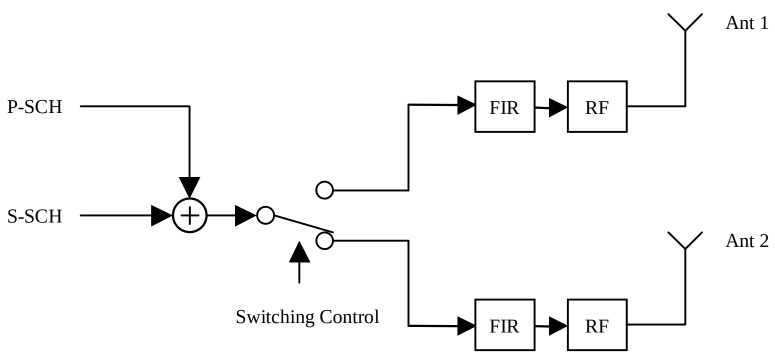


Figure 24. Downlink transmitter structure to support Transmit Diversity for SCH transmission (UTRAN Access Point)

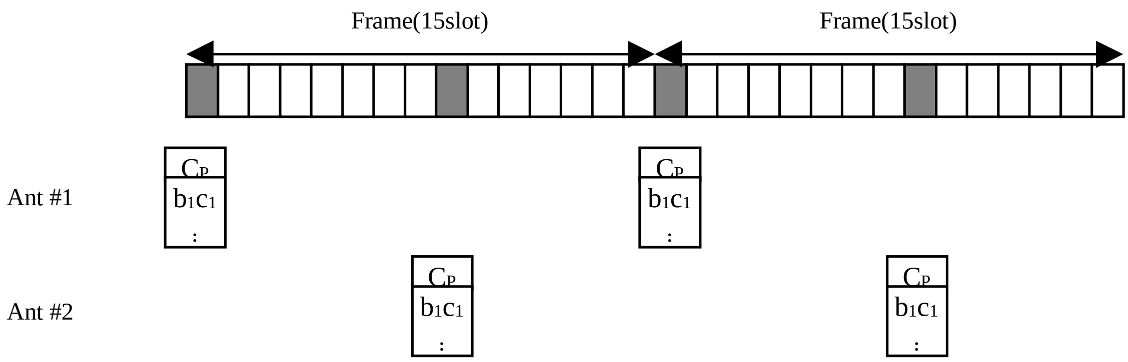


Figure 3~~5~~. Antenna Switching Pattern (Case 2)

4.6~~7~~.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~~7~~.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 6. 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 7, 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.

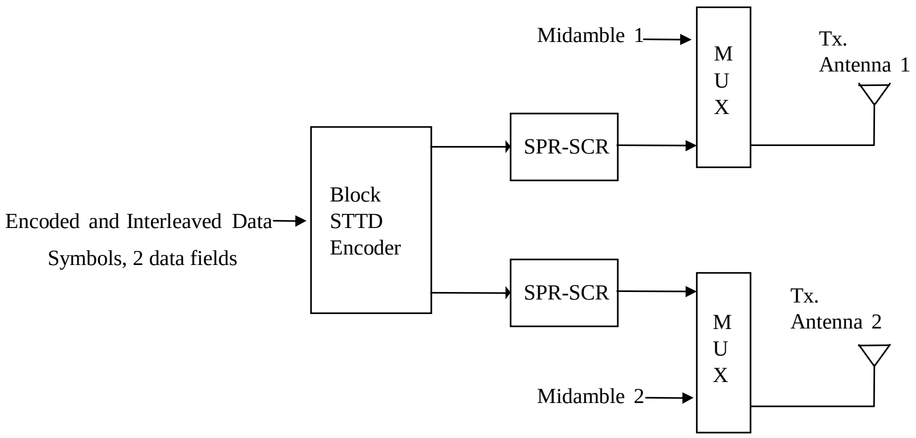


Figure 4~~6~~: Block Diagram of the transmitter (STTD)

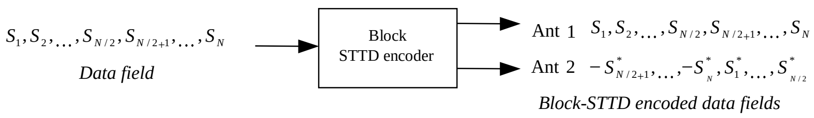


Figure ~~7~~5: Block Diagram of Block STTD encoder. The symbols S_i are QPSK. N is the length of the block to be encoded