TSG-RAN Working Group 1 Meeting #17
Stockholm, Sweden, November 21-25,2000

TSGR1#17(00)1470

Source: **Siemens, InterDigital**

Title: **Proposed CR 35r1 to TS25.224 on Radio Link establishment and sync status reporting for TDD**

Document for: **Decision**

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1 Introduction

This document proposes procedures for Radio Link establishment and Sync Status reporting for TDD. It follows the general approach recently defined for FDD, including the introduction of two phases.

This proposal incorporates the transmission and detection of the TDD Special Bursts into the process. The use of Special Bursts for TDD in the event of DTX has been an established feature of TDD, but prior to this proposal, no procedure has been defined to specify either the criteria for transmission of these bursts or the criteria for use of special burst detections to establish the In-Sync condition or to avoid false declaration of the Out-of-sync condition.

Addtionally, this CR corrects several typographical errors.

2 Specific Changes

Section 4.2.2.3.2 Power Control Loop corrects an obvious typographical error.in the definition of SIR

Section 4.2.2.3.3 Out of synchronisation handling defines the conditions for the UE to turn off its Transmitter. The criteria for this action are that the UE estimates the signal quality over an estimation window to be below a threshold and also fails to detect a Special Burst within the search window. The window for both quality estimation and Special Burst detection is 160 ms when the beacon power is less than 10 above the handover triggering level, and 320 ms when the beacon power is more than 10dB above the handover triggering level. This is unchanged from the existing Version. The UE may turn power back on if either the estimated quality is above the threshold or a Special Burst is detected.

Section 4.4.2.1.2 Downlink synchronisation primitives defines two phases, as exist for FDD. Out of Sync is declared when all three conditions occur::

?? Estimated signal quality below a threshold

?? Failure to detect a Special Burst

?? Failure to detect a correct CRC

In the first phase the estimation/search window is 40 ms; in the second phase it is 160 ms, or 320 ms, depending on received strength of the beacon power.

In Sync shall be declared if any one of the three conditions occur:

?? Estimated signal quality above a threshold

?? Detection of a Special Burst

?? Detection of a correct CRC

Sections 4.4.2.1.3 Uplink synchronisation primitives, 4.4.2.2.1 Downlink radio link failure, and 4.4.2.2.2 Uplink radio link failure/restoreclarify that Synchronization Status for TDD is based on CCTrCHs.

Section 4.5 on DTX clarifies the format for the Special Burst and gives rules to specify when these bursts shall be transmitted. The highest rate will be during initial phase.

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CR-Form-v3

CHANGE REQUEST

✍ **25.224 CR 35** ✍ rev **1** ✍ Current version: **3.4.0** ✍

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

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

Title:	✍	Radio Link establishment and sync status reporting
Source:	✍	Siemens, InterDigital
Work item code:	✍	***Date:*** ✍ 23 November, 2000
Category:	✍ **F**	***Release:*** ✍ R99

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

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	✍	Prior version of in-sync/out-of-sync procedure was ambiguous and incomplete.
Summary of change:	✍	Clarification of use of special bursts and alignment of TDD with FDD two-phase approach..
Consequences if not approved:	✍	Unacceptable delays in declaring initial sync, and erroneous detection of out-of-sync for DTX case.

Clauses affected:	✍	4.2.2.3.2,4.2.2.3.3,4.4.2.1.2,4.4.2.1.2,4.4.2.2,4.4.2.2.1,4.4.2.2.2,4.5
Other specs affected:	✍	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications ✍
Other comments:	✍	

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

1) Fill out the above form. The symbols above marked ✍ contain pop-up help information about the field that they are closest to.
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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

4.2.2.3.2 Power Control Loop

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

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

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

where

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

$L_{P\text{-}CCPCH}$: 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.

?: ? is a weighting parameter which represents the quality of path loss measurements. ? may be a function of the time delay between the uplink time slot and the most recent down link time slot containing a beacon channel, see [8]. ? is calculated at the UE. An example for calculating ? as a function of the time delay is given in annex A.1.

SIR_{TARGET}: Target SINR 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

4.2.2.3.3 Out of synchronisation handling

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

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

- The UE estimates the received dedicated channel burst quality over the last ~~[~~160~~]~~ ms period to be worse than a threshold Q_{out}, and in addition, no special burst, as defined in 4.5, is detected with quality above a threshold, Q_{sbout} ~~This criterion is never fulfilled during the first [160] ms of the dedicated channel's existence~~. Q_{out} and Q_{sbout} are ~~is~~ defined implicitly by the relevant tests in [2]. If the UE detects the beacon channel reception level [10 dB] above the handover triggering level, then the UE shall use a 320 ms estimation period for the burst quality evaluation and for the Special Burst detection window.~~:~~

  ~~- 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 subsequently resume the uplink transmission of the CCTrCH if the following criteria ~~is~~ are fulfilled:

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

  ~~- If the UE detects the beacon channel reception level [10 dB] above the handover triggering level, then the UE shall be allowed to use a further [320] ms estimation period for the burst quality evaluation.~~

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 subclauses.

4.4.2.1.2 Downlink synchronisation primitives

Layer 1 in the UE shall check the synchronization status of each DL CCTrCH individually in every radio frame. ~~check synchronisation status of the downlink dedicated channels.~~ All bursts and transport channels of a CCTrCH shall be taken into account. Synchronisation status is indicated to higher layers, using the CPHY-Sync-IND or CPHY-Out-of-Sync-IND primitives. For dedicated physical channels configured with Repetition Periods [15], only the configured active periods shall be taken into account in the estimation. The status check shall also include detection of the Special Bursts defined in 4.5 for DTX.

The criteria for reporting synchronization status are defined in two different phases.

The first phase lasts until 160 ms after the downlink CCTrCH is considered to be established by higher layers. During this time, Out-of-sync shall not be reported. In-sync shall be reported using the CPHY-Sync-IND primitive if any one of the following three criteria is fulfilled.

a) The UE estimates the burst reception quality over the previous 40 ms period to be better than a threshold Q_{in}. This criterion shall be assumed not to be fulfilled before 40 ms of burst reception quality measurement have been collected.

b) At least one transport block with a CRC attached is received in a TTI ending in the current frame with correct CRC.

c) The UE detects at least one Special Burst. Special Burst detection shall be successful if the burst is detected with quality above a threshold, Q_{sbin}, and the TFCI is decoded to be that of the Special Burst.

The second phase starts 160 ms after the downlink dedicated channel is considered established by higher layers. During this phase both Out-of-Sync and In-Sync are reported as follows.

Out-of-sync shall be reported using the CPHY-Out-of-Sync-IND primitive if all three ~~any~~ of the following criteria are fulfilled:

- the UE estimates the received dedicated channel burst quality over the last ~~[~~160~~]~~ ms period to be worse than a threshold Q_{out}. The value, Q_{out} is defined implicitly by the relevant tests in [2];

- ~~no Special Burst is detected with quality above a threshold Q_{sbout}. This criterion is never fulfilled during the first [160] ms of the dedicated channel's existence.~~ The value Q_{out}-Q_{sbout} is defined implicitly by the relevant tests in [2];

- over the previous 160 ms, no transport block has been received with a correct CRC

I~~f~~ the UE detects the beacon channel reception level [10 dB] above the handover triggering level, the UE shall use~~s~~ ~~[~~320~~]~~ ms estimation period for the burst quality evaluation and for the Special Burst and CRC detection window.~~:~~

~~the last [16] transport blocks, as observed on all TrCHs using CRC, are received with incorrect CRC and 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 any one ~~both~~ of ~~the~~ following criteria is~~are~~ fulfilled:

- the UE estimates the received burst reception quality over the last ~~[~~160~~]~~ ms period to be better than a threshold Q_{in}. The value, Q_{in} is defined implicitly by the relevant tests in [2].

- the UE detects at least one Special Burst with quality above a threshold Q_{sbin}. The value, Q_{sbin}, is defined implicitly by the relevent tests in [2]. ~~This criterion is always fulfilled during the first [160] ms of the dedicated channel's existence.~~ ~~Q_{sbin} is defined implicitly by the relevant tests in [17];~~

- at least one transport block with a CRC attached ~~, as observed on all TrCHs using CRC,~~ is received in a TTI ending in the current frame with correct CRC~~. If there is no TrCH using CRC, this criterion is always fulfilled.~~

If the UE detects the beacon channel reception level [10 dB] above the handover triggering level, the UE uses 320 ms estimation period for the burst quality evaluation and for the Special Burst and CRC detection window.

If no data are provided by higher layers for transmission during the second phase on the downlink dedicated channel then DTX shall be applied as defined in section 4.5.~~In-sync shall be reported using the CPHY-Sync-IND primitive in case of DTX if the following criterion is fulfilled:~~

~~- The UE receives a special burst in case of DTX and estimates its burst reception quality to be better than a threshold $Q_{...}$.~~

How the primitives are used by higher layers is described in [15]. The above definitions may lead to radio frames where neither the In-Sync or Out-of-Sync primatives are reported.

4.4.2.1.3 Uplink synchronisation primitives

Layer 1 in the Node B shall every radio frame check synchronisation status, individually for each UL CCTrCH ~~-~~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 CCTrCHs ~~radio links~~ are monitored by the UE, to trigger radio link failure procedures. The downlink ~~radio link~~ CCTrCH failure ~~criteria~~ status is specified in [15], 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. These primitives shall provide status for each DL CCTrCH separately.

4.4.2.2.2 Uplink radio link failure/restore

The uplink CCTrCHs ~~radio links~~ are monitored by the Node B in order ~~,~~ to trigger CCTrCH~~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 subclause 4.3.2.1. Transitions between those two states are described below.~~

The uplink CCTrCH ~~radio link~~ failure/restore status ~~criteria~~ is reported using ~~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 CCTrCH~~radio link~~ is 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 indicate to higher layers which CCTrCHs are out-of-sync using the synchronization status primitives. Furthermore, the CCTrCH state shall be changed to the out-of-sync state.~~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 a CCTrCH is ~~the radio links are~~ in the out-of-sync state, after receiving N_INSYNC_IND successive in-sync indications Node B shall indicate that the CCTrCH has ~~trigger the RL Restore procedure and indicate which radio links have~~ re-established synchronisation and the CCTrCH's state shall be changed to the in-sync state. ~~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 [16].

4.5 Discontinuous transmission (DTX) of Radio Frames

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

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

4.5.1 Use of Special Bursts fo DTX

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

~~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 special burst should be generated and transmitted in the next possible frame.~~

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

4.5.2 Use of Special Bursts for Initial Establishment

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