TSG-RAN Meeting #10 *TSGRP#10(00)608*
Bangkok, Thailand, 6 - 8 December 2000

Title: **Agreed CRs to TS 25.402**

Source: **TSG-RAN WG3**

Agenda item: **5.3.3**

Tdoc_Num	Specification	CR_Num	Revision_Nu	CR_Subject	CR_Categor	WG_Status	Cur_Ver_Nu	New_Ver_Nu
R3-002583	25.402	010		Timing Advance description correction	F	agreed	3.3.0	3.4.0
R3-002612	25.402	011		Sync port accuracy	F	agreed	3.3.0	3.4.0
R3-003125	25.402	012		UE synchronisation when UE chenges from	F	agreed	3.3.0	3.4.0

Document R3-002583
e.g. for 3GPP use the format TP-99xxx or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

TS 25.402 CR 010 Current Version: 3.3.0

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

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

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

Source: R-WG3 **Date:** 10/2000

Subject: Timing Advance description correction

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 text in 25.402 on timing advance needs to be update to be clearer and to take into account recent corrections made in the timing advance procedures.

If this CR is not approved the timing advance overview section will not be unambiguous and will not be inline with other recent changes in timing advance procedures

Clauses affected: 8.3.4

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:

8.3.4 Timing Advance

Timing Advance is used in uplink to align the uplink radio signals from the UE to the UTRAN both in case of uplink Dedicated Physical Channels (DPCH) and of Physical Uplink Shared Channels (PUSCH).

The handling of timing advance can be divided in four main categories: measurement, initial assignment, ~~correction~~updates during operation, and setting on handover. For each category, a number of different cases can be distinguished.

1. Measurement of the timing ~~offset~~deviation on the physical channels:
   - On PRACH transmissions;
   - On DPCH transmissions;
   - On PUSCH transmissions.
2. Assignment of correct timing advance value when establishing new channels:
   - At ~~switch to DCH/DCH~~transition to CELL_DCH state;
   - ~~At switch to USCH state.~~When establishing an USCH in CELL_FACH state.
3. ~~Correction~~Update of timing advance value for channels in operation:
   - ~~At least one uplink DCH in operation~~UE in CELL_DCH state;
   - ~~Only USCH in operation~~UE with USCH in CELL_FACH state.
4. Setting of timing advance value for target cell at handover:~~.~~
   - Handover from TDD to TDD with synchronised cells;
   - Handover from TDD to TDD with unsynchronised cells;
   - Handover from FDD to TDD;
   - Handover from other systems to TDD.

8.3.4.1 Measurement of the timing ~~offset~~deviation on the physical channels

Timing ~~offset~~deviation measurements are always performed in the physical layer in Node B. These measurements have to be reported to the higher layers, where timing advance values are calculated and signalled to the UE. For this reporting, a number of different ways are foreseen, depending on the used physical channels.

PRACH: The Node B physical layer measures the timing ~~accuracy of the RACH bursts transmitted by the UE. It measures the timing offset~~deviation of the received PRACH signal (~~Rx~~ RX Timing Deviation) and passes this together with the transport block to the CRNC (by means of the Iub RACH Frame Protocol). In case the RACH carries a DCCH or DTCH~~PRACH supports a DCH~~, the measured timing ~~offset~~deviation may be passed from DRNC to the SRNC over Iur interface (by means of the Iur RACH Frame Protocol). Note: PRACH transmissions themselves are transmitted with a large guard period so they do not require timing advance.

PUSCH: The Node B physical layer measures the timing ~~accuracy of the PUSCH bursts transmitted by the UE. It measures the timing offset~~deviation of the received PUSCH signal (~~Rx~~ RX Timing Deviation) and passes this together with the transport block to the CRNC (by means of the Iub USCH Frame Protocol).

DPCH: The Node B physical layer measures the timing ~~accuracy of the DPCH bursts transmitted by the UE. It measures the timing offset~~deviation of the received DPCH signal (~~Rx~~ RX Timing Deviation) and passes this ~~together with the transport block~~value, if the conditions for reporting the measurement are met, to the SRNC (by means of the Iub & Iur DCH Frame Protocols).

8.3.4.2 Assignment of correct timing advance value when establishing new channels

8.3.4.2.1 ~~Switch to DCH/DCH state~~Transition to CELL_DCH State

The transition to ~~DCH/DCH~~CELL_DCH state from ~~USCH/DSCH state, RACH/FACH state~~CELL_FACH state or Idle Mode operates in the following manner:

- The SRNC checks whether an up to date timing ~~offset~~deviation measurement is available. Such a measurement can be available from a recent RACH access (e.g. from initial access) or from a recent USCH transmission. If no up to date timing ~~offset~~deviation measurement is available, e.g. because of lack of uplink transmissions, or during USCH over Iur, the SRNC is not informed about Rx Timing Deviations, and ~~the SRNC~~ has to trigger an uplink transmission from the UE before it can assign a DCH (for example, a RRC procedure requiring a response from the UE). The SRNC calculates the required timing advance value and saves it in the UE context in the SRNC for later use in dedicated or shared channel activation.

- The SRNC attaches the timing advance value to the channel allocation message that it signals to the UE via FACH (RRC CONNECTION SETUP or RADIO BEARER SETUP).

- When the UE receives the channel allocation message it configures its physical layer with the given absolute timing advance value. When a timing advance command is signalled to the UE, the CFN that the new timing advance is to be applied is always signalled.

8.3.4.2.2 ~~Switch to USCH state~~When establishing an USCH in CELL_FACH state

For uplink traffic using the USCH, short time allocations are sent to the UE regularly. Therefore ~~switch to~~establishing an USCH in CELL_FACH state is very similar to handling of timing advance updates during USCH operation. The UTRAN ~~only has to check, whether~~ shall use a~~n~~ ~~up to date~~ recent timing ~~offset~~deviation measurement~~ is available~~. Such a measurement ~~can~~ shall be available from a recent USCH burst or a recent RACH access (e.g. from ~~initial access~~a PUSCH_CAPACITY_REQUEST). ~~If no up to date timing offset measurement is available, the UTRAN has to trigger an uplink transmission from the UE before it can assign an USCH.~~

8.3.4.3 ~~Correction~~Update of timing advance value for channels in operation

8.3.4.3.1 UE in ~~Traffic using at least one uplink DCH~~CELL_DCH state

An UE that is operating a dedicated channel (~~DCH/~~CELL_DCH state), has to update the timing advance from time to time to keep the received signal at the Node B within the required time window. Under reasonable assumptions the worst case update frequency is in the order of 8 seconds.

The timing ~~correction~~advance update procedure operates in the following manner:

1. The SRNC determines whether a new timing advance value has to be transmitted to the UE taking into account ~~when the last correction was signalled.~~the timing deviation measurements. The new timing advance value is calculated taking into account the UE's current timing advance value.

2. ~~Timing advance corrections~~The new timing advance value and the CFN in which it is to take effect are signalled to the UE via RRC signalling on FACH or DCH (PHYSICAL CHANNEL RECONFIGURATION, TRANSPORT CHANNEL RECONFIGURATION, RADIO BEARER RECONFIGURATION or ~~RADIO BEARER RECONFIGURATION).~~UPLINK PHYSICAL CHANNEL CONTROL are examples of possible messages on the DCCH).

3. The SRNC shall also send the updated timing advance value and the CFN in which it is to take effect to the Node B, using a user plane control message. The Node B may adjust its physical layer to take the change in uplink transmission into account.

~~4.~~4. When the UE receives~~the~~ a new timing advance value, it shall configure~~s~~ its physical layer so that the updated timing advance value takes effect on the given CFN specified within the RRC message. The timing advance value shall be applied to all DPCHs and, if present, to all PUSCHs.

There is no need for the UE to acknowledge the timing ~~correction message: the Node B periodically measures the UE timing accuracy,~~advance update: the Node B continually measures and reports the UE timing deviation and the UE reports the received timing advance value as part of ~~the~~its measurement reporting. The SRNC is ~~then~~thus able to detect ~~when~~if a timing advance ~~message~~update has not been received and needs to be re-sent.

8.3.4.3.2 UE with USCH ~~in~~ Traffic ~~using only USCH~~in CELL_FACH state

If the UE uses an USCH in CELL_FACH state (no DCH), t~~T~~he timing ~~correction~~advance update procedure operates in the following manner:

1. ~~1.~~ The CRNC determines whether a new timing advance value has to be transmitted to the UE taking into account when the last ~~correction~~timing advance update was signalled. Two cases are possible:

   - ~~if~~If the data transfer is uplink after a longer idle period then the UE has to transmit a capacity request on the RACH. The CRNC is therefore informed of any timing ~~error on this RACH;~~deviation on this RACH.

   - ~~if~~If a new allocation follows an USCH transmission, the timing ~~error~~deviation is already known to the CRNC from measurements of the last uplink transmission.

2 ~~2.~~ If a Timing Advance update is needed, the CRNC includes a new timing advance value, and the CFN in which it will take effect in the next USCH allocation message to the UE (PHYSICAL SHARED CHANNEL ALLOCATION).

3 The CRNC shall also send a user plane control message indicating the CFN and the updated timing advance value to the Node B so the Node B can adjust its physical layer averaging to take the change in uplink transmission into account.

4 ~~3.~~ When the UE receives~~the~~ a new timing advance value, the UE shall ~~it~~ configure~~s~~ its physical layer, so that the updated timing advance value takes effect on the given CFN specified within the PHYSICAL SHARED CHANNEL ALLOCATION message The timing advance value shall be applied to all present PUSCHs.

8.3.4.4 Setting of timing advance value for target cell at handover

8.3.4.4.1 General

Since the uplink radio signals need to be adjusted only because of large enough distances between the UE and the cell transmission, certain cells will have a small enough radius that timing advance needs to not be used. In those cells the timing advance value in the UE is set to zero and UE autonomous adjustment of timing advance upon handover is disabled in the handover messages to the UE.

In these cells, where TA is not applied, the "RX Timing Deviation" measurement can be omitted if no other procedure (e.g. LCS) requires it.

8.3.4.4.2 Handover from TDD to TDD with synchronised cells

~~Traffic transmission is allowed. Since the TDD system has synchronised base stations,~~When two TDD cells are involved in handover and the two cells are sufficiently synchronised, a UE is able to measure the time offset between P-CCPCH reception of the two cells and, consequently, is able to autonomously correct its timing on handover without UTRAN assistance. However to improve the accuracy for the UE calculated timing advance, the SRNC can include an updated timing advance based on the timing ~~offset~~deviation measured by the old cell in the messages triggering the handover in the UE. Note that this update shall apply in the old cell at the specified CFN if handover is performed on a later CFN or if the handover fails and falls back to the old cell. The UE shall use this new value as the basis for the UE autonomous update.

After a successful handover, a response message is transmitted in the new cell. In this message, if the UE ~~can~~autonomously updated its timing advance it shall report the calculated timing advance value, which it is ~~used~~using for access to the new cell. By this way, the SRNC is informed as fast as possible about the absolute timing advance value in the UE, and it can correct the timing advance immediately or in the future based on this value, if necessary.

8.3.4.4.3 Handover from FDD to TDD, Handover from other systems to TDD, or Handover from TDD to TDD with unsynchronised cells

In these cases, since synchronisation between the handover cells is not possible, the new TDD cell must use a burst type with a large enough transmission window to allow the immediate transmission of data without the need of timing advance adjustment in the new cell, since timing adjustment can only be performed in these cells after the first uplink transmission.

3GPP TSG RAN WG3 Meeting #16
Windsor, UK, 16-20 Oct 2000

Document ***R3-002612***

e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.402	**CR**	**011**	Current Version:	V 3.3.0

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

For submission to: RAN #10 — for approval [X] / for information [ ] — strategic [ ] / non-strategic [ ] *(for SMG use only)*

list expected approval meeting # here ↑

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: R-WG3 **Date:** 10 Oct 2000

Subject: Synch Port Accuracy

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: Required Synch Port Accuracy has to be in line with definitions by 3GPP TSG RAN WG4

Consequences if not accepted:
Inconsistency between TS25.123 and TS25.433

Clauses affected: 2; 6.1.2.1

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:

help.doc

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

1 Scope

The present document constitutes the stage 2 specification of different synchronization mechanisms in UTRAN and on Uu.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- For this Release 1999 document, references to 3G documents are for Release 1999 versions (version 3.x.y).

[1] 3GPP TS 25.401: "UTRAN Overall Description".

[2] 3GPP TS 25.423: "UTRAN I_{ur} Interface RNSAP Signalling".

[3] 3GPP TS 25.433: "UTRAN I_{ub} Interface NBAP Signalling".

[4] 3GPP TS 25.435: "UTRAN I_{ub} Interface User Plane Protocols for COMMON TRANSPORT CHANNEL Data Streams".

[5] 3GPP TS 25.427: "I_{ub}/I_{ur} Interface User Plane Protocol for DCH Data Streams".

[6] EIA 422-A-78: "Electrical characteristics of balanced voltage digital interface circuits".

[7] 3GPP TS 25.411: "UTRAN Iu Interface Layer 1".

[8] 3GPP TS 25.421: "UTRAN Iur Interface Layer 1".

[9] 3GPP TS 25.431: "UTRAN Iub Interface Layer 1".

[10] 3GPP TS 25.104: "UTRA (BS) FDD; Radio transmission and Reception".

[11] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".

[12] 3GPP TS25.223: "Spreading and modulation (TDD)".

[13] 3GPP TS25.215: "Physical layer - Measurements (FDD)".

[14] 3GPP TS25.225: " Physical layer - Measurements (TDD)".

[15] 3GPP TS25.123: "Requirements for Support of Radio Resource Management".

6.1.2 Inter Node B Node Synchronization

In the FDD mode Inter Node B Node Synchronization could be reached via the RNC-Node B Node Synchronization in order to determine inter Node B timing reference relations.

This could be used to determine Inter-cell relationships (considering T_cell) which can be used in the neighbour cell lists in order to speed up and simplify cell search done by UE at handover.

In TDD Inter Node B Node Synchronization is used to achieve a common timing reference among Node B's (see Figure 5), that allows to support Intercell Synchronization.

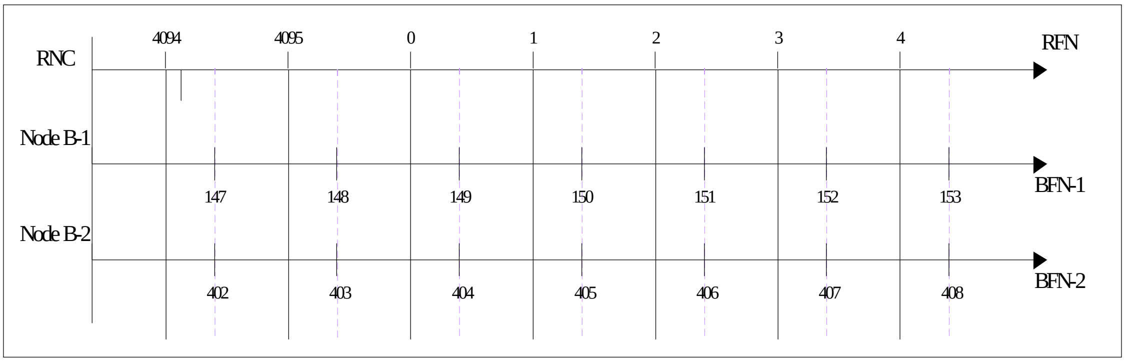

Figure 1: Synchronization of BFNs through TDD Inter Node B Synchronization

In TDD Inter Node B Node Synchronization may be achieved via a standardised synchronization port (see subclause 6.1.2.1) that allows to synchronise the Node B to an external reference.

6.1.2.1 TDD Node B Synchronization Ports

This subclause defines the Node B input and an output synchronization ports that can be used for Inter Node B Node Synchronization. These synchronization ports are optional.

The input synchronization port (SYNC IN) allows the Node B to be synchronised to an external reference (e.g. GPS), while the output synchronization port (SYNC OUT) allows the Node B to synchronise directly another Node B (see Figure 6).

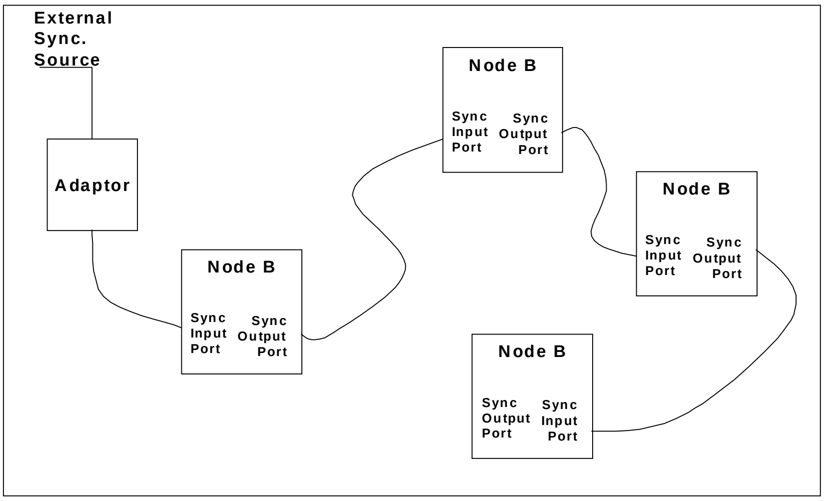

Figure 6: Usage of Synchronization Ports

This allows to connect Node B's in a daisy chain configuration, so that a single external reference is enough and all remaining nodes B can be synchronised (e.g. in case of indoor operation).

The Node B starts the synchronization to the external reference when a valid input synchronization signal is detected at the input synchronization port.

If a valid synchronization signal is detected, the Node B regenerates that signal at its output synchronization port. ~~The propagation delay between the input and output synchronization ports shall not exceed 500 ns.~~

The electrical characteristics of the synchronization ports shall conform to RS422 [6] (output synchronization port: subclause 4.1; input synchronization port: subclause 4.2).

The synchronization signal (illustrated in Figure 7) is a 100 Hz signal having positive pulses of width between 5 µs and 1 ms, except when SFN mod 256 = 0 (every 256th pulse), which has a pulse width between 2 ms and 5 ms. This signal establishes the 10 ms frame interval and the 2.56 s multiframe interval. The start of all frames in the cell of the node B is defined by the falling edge of the pulse. The required accuracy for the phase difference between the start of the 10ms frame interval and the falling edge of the synchronisation pulses is defined in [15].

The start of the 256 frame period is defined by the falling edge of the pulse corresponding to the frames where SFN mod 256 =0 (i.e. of width between 2 ms and 5 ms).

The synchronization signal at the input port shall have a frequency accuracy better than the one of the Node B.

The relative phase difference of the synchronization signals at the input port of ~~two neighbouring~~ any Node B~~'s~~ in the synchronised area shall not exceed ~~5~~ 2.5µs.

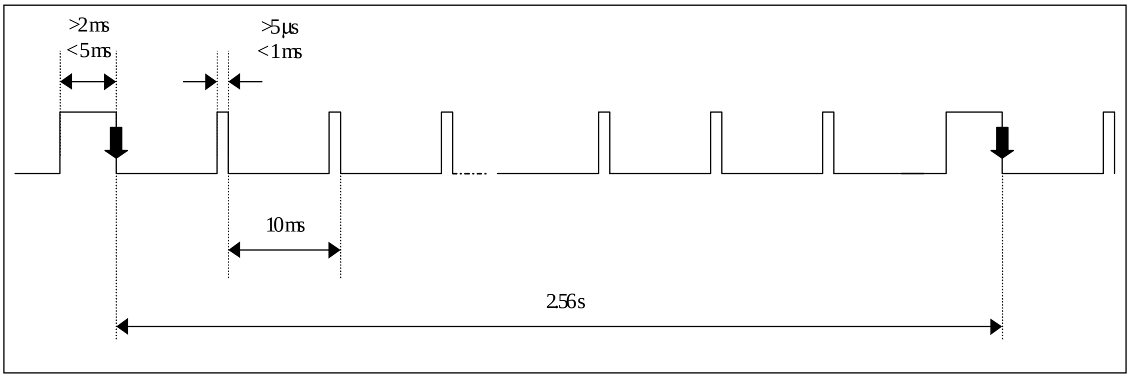

Figure 7: Synchronization signal

Synchronization by a GPS receiver

The signal transmitted by a Global Positioning System (GPS) satellite indicates the GPS time that provides an absolute time reference. This makes the GPS receiver suitable for Inter Node B Node Synchronization.

Inter Node B Node Synchronization is achieved by relating the synchronization signal (at the input synchronization port to the GPS signal. Since the period of this signal is 2.56 s, this implies that every 6400 frames the start of a 256 frame period coincides with an integer GPS second, i.e. a multiframe shall start when GPS time mod 64 = 0.

6.1.2.2 TDD Inter Node B Node Synchronization procedure

Void.

3GPP TSG-RAN Working Group 3 Meeting #17
Chicago, USA, November 20th-24th, 2000

Tdoc R3-003125

CR-Form-v3

CHANGE REQUEST

⌘	**25.402**	**CR**	**CR-012**	⌘ rev	**-**	⌘	Current version:	**3.3.0** ⌘

*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 [ ] Core Network [ ]

Title: ⌘	UE synchronisation when UE changes from CELL_FACH/PCH to CELL_DCH state.		
Source: ⌘	R-WG3		
Work item code: ⌘		***Date:*** ⌘	15/11/00
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)*

R-WG3

Reason for change: ⌘	In section 9.3.1A, when UE changes from CELL_FACH/PCH to CELL_DCH state, case of several RLs, UE shall report *SFN_SFN observed time difference* as defined in 25.215. It is aligned with (9.7) only in the case where CFN = SFN, as explained in 9.3.A. However, there could be a confusion as just before, calculation of CFN is described in (9.6). This calculation (performed in UE) shall be performed when initialising counters in CELL_DCH state, ie after having reported OFF and Tm value to SRNC.
Summary of change: ⌘	It is proposed to invert the order of equations (9.6) and (9.7) in order to avoid any misunderstanding.
Consequences if not approved: ⌘	If not changed, the UE may report OFF and Tm values to the SRNC based on CFN value calculated in (9.6) instead of using CFN = SFN as described in 9.3.A

Clauses affected: ⌘	9.3.1A	
Other specs affected: ⌘	[ ] Other core specifications ⌘ [ ] Test specifications [ ] O&M Specifications	
Other comments: ⌘		

9.3.1A [FDD - UE changes from CELL_FACH/PCH to CELL_DCH state: several RL's]

~~Based on the received $DOFF_{FDD}$ and the SFN_j of the reference cell, the UE initialises the CFN with the value given by formula (9.6)~~

~~$$CFN = ((SFN_j*38400 - DOFF_{FDD}*512) \text{ div } 38400) \text{ mod } 256 \quad (9.6)$$~~

~~After the initialisation, the CFN in the UE is increased (mod 256) by 1 every frame.~~

The UE reports to the SRNC the parameters OFF_k and Tm_k for each $cell_k$ measured respect to the reference $cell_j$ determined by means of formula (9.7)

$$OFF_k + Tm_k = (SFN_k - CFN) \text{ mod } 256 \quad (9.7)$$

After having performed OFF_k and Tm_k measurements for all target cells, the UE initialises the CFN with the value given by formula (9.6) , based on the received $DOFF_{FDD}$ and the SFN_j of the reference cell.

$$CFN = ((SFN_j*38400 - DOFF_{FDD}*512) \text{ div } 38400) \text{ mod } 256 \quad (9.6)$$

After the initialisation, the CFN in the UE is increased (mod 256) by 1 every frame.