TSG-RAN Meeting #14
Kyoto, Japan, 11 - 14, December, 2001

TSGRP#14(01) 0866

Title: **Agreed CRs to TS 25.838**

Source: **TSG-RAN WG3**

Agenda item: **8.3.3/8.3.4/9.4.3**

RP Tdoc	R3 Tdoc	Spec	CR_Num	Rev	Release	CR_Subject	Cat	Cur_Ver	New_Ver	Workitem
RP-010866	R3-013175	25.838	001		Rel-4	Introduction of the Frequency Acquisition Phase and updates of	F	4.0.0	4.1.0	RANimp-Nbsync

3GPP TSG-RAN3 Meeting #25 ***R3-013175***
Makuhari, Japan, 26th –30th November 2001

CR-Form-v3

CHANGE REQUEST

⌘ **25.838** **CR** **001** ⌘ rev **-** ⌘ Current version: **4.0.0** ⌘

*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 ☐ Radio Access Network ☒ Core Network ☐

Title:	⌘	Introduction of the Frequency Acquisition Phase and updates of IEs, EPs, and messages
Source:	⌘	R-WG3
Work item code:	⌘	RANimp-Nbsync
Date:	⌘	November 2001
Category:	⌘	**F**
Release:	⌘	REL-4

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

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	The Frequency Acquisition Phase is not included in this TR but it is explained in the relevant TS 25.402 and TS 25.433. In addition the Information Elements, Elememtary Procedures, and Messages should be aligned with NBAP.
Summary of change:	⌘	Introduction of the Frequency Acquisition Phase Re-numbering of the Initial Phase Steps Correction on the Iub round trip delay in the Preliminary Phase Updating of the Information Elements, Elememtary Procedures, and Messages to be aligned with NBAP Impact Analysis: Impact assessment towards the previous version of the specification (same release): This CR has no impact with the previous version of the specification (same release) because the added text corresponds to the already existing provisions in the 25.433 REL-4 and 25.402 REL-4.
Consequences if not approved:	⌘	If this CR is not aprroved, the Frequency Acquisition is still missing in this TR.

Clauses affected:	⌘	6.1.1, 6.2.1.1a (new), 6.3.2, 7 (all)		
Other specs affected:	⌘	☐ Other core specifications ☐ Test specifications ☐ O&M Specifications	⌘	

Other comments:	⌘	This CR was in principle agreed with modification at R3#24 meeting (R3-012929) with the following comment: - 6.1.1: rephrase to “half the Iub round trip delay”

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.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.
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.

6 Study Areas

This section gives a summary of areas that have been identified where work needs to be performed to complete the work item.

6.1 Over the air Cell Synchronisation mechanism

For cell synchronisation over the air interface 3 different synchronisation stages are distinguished:

- Initial synchronisation,
  The initial synchronisation is used when a TDD network is newly established and has to be synchronised. It is assumed that none of the cells is supporting traffic at this time.

- Steady-State phase,
  In the steady state phase the synchronisation mechanism during normal operation applies.

- Late-Entrant cells,
  Synchronisation mechanism for cells to be added to a synchronous network or cells recovering from loss of radio interface synchronisation.

6.1.1 Initial Synchronisation

Preliminary Phase:

1) There should be at least one cell in each RNC area (i.e. in the RNS) which is synchronised by an external reference (e.g. GPS). This cell should determine the local time modulo SFN period (40,96 sec.).
2) The RNC has to know at which of the cells the external reference is connected.
3) The RNC retrieves the reference timing signal from the cells with GPS. When receiving the response, the RNC adjusts its internal clock RFN (RNC Frame Number), compensating the Iub delay by subtracting half of the known round trip Iub delay.
4) Now the RNC proceeds by updating the timing of all the remaining cells in the RNS, instructing them to adjust their clocks. Each of the timing offsets is again adjusted by half the Iub round trip delay for that cell. - The result is: All the cells are "roughly synchronised", with an inaccuracy corresponding to the uncertainty of the Iub interface signalling transmission time, which is likely to be more than 1 radio frame.

Frequency Acquisition Phase:

The frequency acquisition phase is used to bring cells of an RNS area to within frequency limits prior to initial synchronisation. No traffic is supported during this phase.

1) The cell(s) identified as reference cell, i.e. external reference clock is connected to, shall transmit continuously cell sync bursts in every time slot where possible.
2) All other cells are considered as unlocked (i.e. not in frequency lock) shall listen for transmission from other cells and perform frequency locking to any transmission received.
3) A cell shall signal completion of frequency acquisition to the RNC, as soon as it has locked its frequency to the received signal, fulfilling the Frequency Stability requirement set in TS 25.105.
4) If the cell(s) have received transmission request on instructing the frequency acquisition and the cell(s) have performed frequency locking, the cell(s) shall begin transmitting the specified code for frequency locking of other cells.
5) When the RNC has received completion of frequency acquisition signals from all cells the frequency acquisition phase is completed.

Initial Phase:

1) ~~5)~~ For the sync procedure it is useful to know which cells can “hear” each other. However, during the initial phase, it is assumed that there is yet no information available on which to base the generation of a re-use pattern for sync transmissions. Thus all cells are instructed to transmit their cell sync bursts in turn one after the other. The same cell sync burst signal is used by all cells.

2) ~~6)~~ All cells listen for transmissions and those which successfully detect a cell sync burst report their timing and received S/(N+I) to the RNC. Knowing the schedule, the RNC is able to determine the cell which made the transmission and place a measurement entry in the relevant place in its inter-cell connectivity matrix. After all cells have made their transmissions, the RNC computes the set of timing updates which will bring the cells nominally into synchronisation.

3) ~~7)~~ Steps ~~5~~1 and ~~6~~2 are repeated several times (typically 10). This serves two purposes:

- The rapid updates allow the correction of the clock frequencies as well as the clock timings to be adjusted in a short period of time. This rapidly brings the network into tight synchronisation.
- The S/(N+I) values are averaged over this period. This provides more accurate measurements (averaging over noise and fading) which can be used in the automatic generation of a re-use plan.

4) ~~8)~~ The S/(N+I) values in the connectivity matrix are used by the RNC to plan a re-use pattern. This is performed as follows:

- A matrix of minimal connectivity is computed where pairs of cells are labelled as “minimal neighbours” if either their estimated average S/(N+I) exceeds a threshold or if they have at least one neighbour in common.
- The set of cells is divided into partitions where cells which are in the same partition are sufficiently separated and can therefore be allowed to send the same cell sync burst at the same time. For this purpose each partition must satisfy the requirement that no pairs of cells within that partition are minimally connected.

6.1.2 Steady-State Phase

At this point, each cell gets a "cell synch burst plan" which tells the cell what to do whenever e.g. their SFN modulo 128 = 0. Based on that plan, they start transmitting or receiving cell sync bursts, respectively, and they report the relative time of cell synch burst reception, among others, to the RNC.

1) All cells in the same partition are arranged to transmit / receive in the same cell sync frames according to the above procedure and they transmit the same cell sync burst signal in parallel. All cells report the reception times for all relevant burst signals back to the RNC. In order to decrease the number of messages over Iub, the measurement reports may be sent only when a certain threshold is exceeded.

2) At the end of each cycle, the RNC collates the information. In general there should always exist a path of bidirectional valid measurements that links every cell either directly or indirectly to a cell with reference clock. However, the model is arranged such that only those cells which have such a path will be updated on any given occasion.

3) The process of partition transmissions and updating then continues indefinitely

6.1.3 Late-Entrant Cells

The scheme for introducing new cells into a synchronised RNS is as follows:

- There is a specialised sync transmission at regular intervals or event driven. A single common cell sync burst is transmitted in parallel by *all* cells which are synchronised in the system. The late entrant cell will correlate against the specialised sync transmissions. The late entrant cell will take the earliest reception as the timing of the system.
- Thus, at this point, the late entrant cell has obtained system time, subject to an unknown propagation delay between it and its nearest neighbour. At this time, the late entrant cell cannot tell which of its neighbours *is* the nearest. However, this level of synchronisation is good enough that from then on the late entrant cell can distinguish the overlaid normal sync transmissions unambiguously for the various code shifts.
- After this time the late entrant cell can measure the timings of sync transmissions received from specific cells and report these to the RNC. In turn, the RNC can give the late entrant cell its own schedules for cell sync burst

transmission and reception. The RNC can then use the bi-directional sounding, which will then be available, to compute the true timing error and to instruct the cell to adjust its timing appropriately.

6.2 Synchronisation Signalling aspects

6.2.1 Initial Synchronisation

This stage covers the "Preliminary Phase" where the Node B is roughly synchronised via Iub interface messages, and the "Initial Phase" where the radio interface timing of the cells is fine-tuned via radio for the first time.

6.2.1.1 Preliminary Phase

Iub signalling in the preliminary phase shall serve the following purposes:

- Reference cell identification: The CRNC shall be informed at which of the cells the external reference clock (GPS receiver) is connected.
- Reference time retrieval: For the initial adjustment, the reference time of a cell where a GPS receiver is connected has to be requested.
- Initial Synchronisation adjustment: The reference time has to be provided to the cells without the GPS receiver.

This implies the following signalling:

Reference Cell Identification:

The proposed solution to solve the first requirement is to add the information about the reference clock availability within the RESOURCE STATUS INDICATION message that is sent from the Node B to the RNC when a Local Cell becomes existing at the Node B.

At Cell Setup a ‘Reference SFN offset’ may be given to the cells where the reference clock is connected in order to separate the synchronisation bursts from different RNC areas.

Reference Time Retrieval:

For the reference time retrieval the DL Transport Channels Synchronisation procedure on the PCH frame protocol (see [6]) can be used. At this phase, a timing granularity of one radio frame is considered sufficient, which can be achieved by retrieval of the SFN which the Node B has derived from the external reference clock.

Initial Synchronisation Adjustment:

For the cells to adjust first the DL Transport Channels Synchronisation procedure on the PCH frame protocol shall be performed in order to determine the deviation from the reference SFN.

By means of the Synchronisation Adjustment procedure the Frame Adjustment value is then transmitted to the cells without GPS receiver.

Information elements required for Synchronisation Adjustment:

- Frame Adjustment value

6.2.1.1a Frequency Acquisition Phase

The frequency acquisition phase is used to bring cells of an RNS area to within frequency limits prior to initial synchronisation. No traffic is supported during this phase.

Reference Cell Transmission

The cell(s) identified as reference cell, i.e. external reference clock is connected to, shall transmit cell sync bursts according to the information given in the CELL SYNCHRONISATION INITIATION REQUEST message.

Other Cell Reception

All other cells are considered as unlocked (i.e. not in frequency lock) shall listen for transmission from other cells and perform frequency locking to any transmission received. For setting the parameters within the Node B to listen for transmission from other cells, the CELL SYNCHRONISATION INITIATION REQUEST message is used.

A cell shall signal completion of frequency acquisition to the RNC via a CELL SYNCHRONISATION REPORT message, as soon as it has locked its frequency to the received signal, fulfilling the Frequency Stability requirement set in TS 25.105, and the cell should automatically start acting like a reference cell i.e. to commence transmission cell sync bursts for frequency locking of other cells.

The process continues until the RNC has received completion of frequency acquisition signals from all cells at which point it sends a CELL SYNCHRONISATION TERMINATION REQUEST message to each cell to stop all transmissions.

6.2.1.2 Initial Phase

/* partly omitted */

6.3.2 Information elements

Within the Cell Sync burst instruction definitions the transmission of cell sync bursts during the different phases have to be initiated and measurements are started in parallel. The following table summarises the information elements required within the individual synchronisation phases.

	~~**Initial Phase**~~	~~**Late Entrant Cells**~~	
~~**Cell Synchronisation Initiation Request**~~		~~**Special Cell Sync Burst to transmit**~~	~~**Special Cell Sync Burst measurement from new cell**~~
~~**Cell sync burst transmission initiation**~~	~~SFN (Start Frame)~~	~~SFN (Special Sync Burst to transmit)~~	
	~~Repetition Period~~		
	~~Tx Cell Sync Burst Code~~	~~Tx Cell Sync Burst Code~~	
	~~Tx Power~~	~~Tx Power~~	
~~**Cell sync burst measurement initiation**~~	~~Rx Cell Sync Burst Code~~		~~SFN (when cell sync burst is transmitted)~~
	~~Report characteristics~~		~~Rx Cell Sync Burst Code~~
			~~Report characteristics~~

	Initial Phase	**Frequency Acquisition Phase**	**Late-Entrant Cells**	
Cell Synchronisation Initiation Request			**Special Cell Sync Burst to transmit**	**Special Cell Sync Burst measurement from new cell**
Cell sync burst transmission initiation	SFN (Start Frame)	SFN (Start Frame)	SFN (Special Sync Burst to transmit)	

	Repetition Period	Repetition Period		
	Tx Cell Sync Burst Code	Tx Cell Sync Burst Code	Tx Cell Sync Burst Code	
	Tx Cell Sync Burst Code Shift	Tx Cell Sync Burst Code Shift	Tx Cell Sync Burst Code Shift	
	Tx Power	Tx Power	Tx Power	
Cell sync burst measurement initiation	Rx Cell Sync Burst Code	Rx Cell Sync Burst Code		SFN (when cell sync burst is transmitted)
	Rx Cell Sync Burst Code Shift	Rx Cell Sync Burst Code Shift		Rx Cell Sync Burst Code
	Report characteristics	Report characteristics		Rx Cell Sync Burst Code Shift
				Report characteristics

Table 1: Information elements for Initial Phase and Late-Entrant cells

In the steady-state phase the synchronisation schedule defines a number of cells transmitting each a cell sync burst at the same time, which shall be measured from another number of cells. The individual cell sync bursts are distinguished by different cell sync codes and cell sync code shifts.

To define the SFN where to transmit/receive, the SFN period is divided into cycles, that have the same schedule. Within a cycle each cell receives for each slot an individual set of parameters for the cell sync bursts to transmit/receive.

	Steady-State Phase
Cell Synchronisation Reconfiguration Request	
Cell sync burst schedule	Number of cycles per SFN period
	Number of ~~slots~~repetitions per cycle
Cell sync burst transmission reconfiguration	~~Slot~~Sync Frame number per cycle to transmit
	Tx Cell Sync Code
	Tx Cell Sync Code shift
	Tx Power
Cell sync burst measurement reconfiguration	~~Slot~~Sync Frame number per cycle to receive
	For all simultaneous receptions
	Rx Cell Sync Code
	Rx Cell Sync Code shifts
	Report characteristics

Table 2: Information elements for Steady-State Phase

	~~Initial Phase~~	~~Steady-State Phase~~	~~Late-Entrant Cells~~
~~**Cell Synchronisation Report**~~	~~SFN where cell sync burst has been received~~	~~SFN where cell sync burst has been received~~	
	~~Cell Sync Burst Timing~~		
	~~Cell Sync Burst SIR~~	~~For all simultaneous receptions~~	
		~~Cell Sync Burst Timing [8 bits]~~	
		~~Cell Sync Burst SIR~~	

	Initial Phase	Steady-State Phase	Late-Entrant Cells	Frequency Acquisition
Cell Synchronisation Report	SFN where cell sync burst has been received	SFN where cell sync burst has been received	NULL	NULL
	Cell Sync Burst Timing			
	Cell Sync Burst SIR	For all simultaneous receptions		
		Cell Sync Burst Timing [8 bits]		
		Cell Sync Burst SIR		

Table 3: Information elements for Cell Synchronisation reports

For Late-Entrant Cells and Frequency Acquisition Phase the CELL SYNCHRONISATION REPORT message is only sent once without reporting parameters or measurements to indicate that the phase is completed.

/* partly omitted */

7 Agreements and associated agreed contributions

This section documents agreements that have been reached and makes reference to contributions agreed in RAN-WG3 with respect to this study item. This section is split according to the above mentioned Study Areas.

7.1 Synchronisation Instructions

7.1.1 EP for Cell Sync Burst instructions

Following Class 1 procedures shall be defined for cell sync burst instruction settings:

~~Elementary Procedure~~	~~Message~~	~~Successful Outcome~~	~~Unsuccessful Outcome~~	
		~~Response message~~	~~Response message~~	~~Timer~~
~~Cell Sync Burst Initiation~~	~~CELL SYNCHRONISATION INITIATION REQUEST~~	~~CELL SYNCHRONISATION INITIATION RESPONSE~~	~~CELL SYNCHRONISATION INITIATION FAILURE~~	
~~Cell Sync Burst Reconfiguration~~	~~CELL SYNCHRONISATION RECONFIGURATION REQUEST~~	~~CELL SYNCHRONISATION RECONFIGURATION RESPONSE~~	~~CELL SYNCHRONISATION RECONFIGURATION FAILURE~~	

Elementary Procedure	**Message**	**Successful Outcome**	**Unsuccessful Outcome**
		Response message	**Response message**
Cell Sync Burst Initiation	CELL SYNCHRONISATION INITIATION REQUEST	CELL SYNCHRONISATION INITIATION RESPONSE	CELL SYNCHRONISATION INITIATION FAILURE
Cell Sync Burst Reconfiguration	CELL SYNCHRONISATION RECONFIGURATION REQUEST	CELL SYNCHRONISATION RECONFIGURATION RESPONSE	CELL SYNCHRONISATION RECONFIGURATION FAILURE

For report of the measured cell sync bursts, for terminating the started cell sync burst transmission and for failure cases, the following class 2 EPs shall be defined:

Elementary Procedure	Message
Cell Sync Burst Reporting	CELL SYNCHRONISATION REPORT
Cell Sync Burst Termination	CELL SYNCHRONISATION TERMINATION REQUEST
Cell Sync Burst Failure	CELL SYNCHRONISATION FAILURE INDICATION

7.1.2 Cell Sync Burst instruction procedures

/* partly omitted */

7.1.3 Cell Sync Burst instruction message definitions

7.1.3.1 CELL SYNCHRONISATION INITIATION REQUEST

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE Type and Reference~~	~~Semantics Description~~
~~Message Discriminator~~				
~~Message Type~~				
~~Transaction Id~~				
~~C-ID~~				
~~Common physical channel ID~~	~~M~~			

~~**Cell Sync Burst Transmission Initiation**~~		~~0..1~~		
~~>SFN~~	~~M~~			
~~>Cell Sync Burst Code~~	~~M~~			
~~>Cell Sync Burst Repetition Period~~	~~M~~			~~Repetition Period = 0 for late entrant cells~~
~~>Initial DL transmission Power~~	~~M~~	~~DL Power~~		
~~**Cell Sync Burst Measurement Initiation**~~		~~0..1~~		
~~>Cell Sync Burst Code~~	~~M~~			
~~>Cell Sync Burst Report Type~~	~~M~~		~~ENUMERATED (Initial Phase, Steady-State Phase, Late-Entrant Cell, ..)~~	
~~>SFN~~	~~O~~			~~Indicates SFN when special Cell Sync Burst is transmitted for late entrant cells~~
~~>Synchronisation Report Characteristics~~	~~M~~			

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	reject
Transaction ID	M		9.2.1.62		–	
C-ID	M		9.2.1.9		YES	reject
Cell Sync Burst Repetition Period	M		9.2.3.4J		YES	reject
Time Slot Information		1..15			GLOBAL	reject
>Time Slot	M		9.2.3.23		–	
Cell Sync Burst Transmission Initiation Information		0..1			GLOBAL	reject
>CSB Transmission ID	M		9.2.3.4N			
>SFN	M		9.2.1.53A		–	
>Cell Sync Burst Code	M		9.2.3.4G		–	
>Cell Sync Burst Code shift	M		9.2.3.4H			
>Initial DL transmission Power	M		DL Power 9.2.1.21		–	
Cell Sync Burst Measurement Initiation Information		0..1			GLOBAL	reject
>CSB Measurement ID	M		9.2.3.4I			
>Cell Sync Burst Code	M		9.2.3.4G		–	
>Cell Sync Burst Code shift	M		9.2.3.4H			
>Synchronisation Report Type	M		9.2.3.18E		–	
>SFN	O		9.2.1.53A		–	
>Synchronisation Report Characteristics	M		9.2.3.18D		–	

7.1.3.2 CELL SYNCHRONISATION INITIATION RESPONSE

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	reject
Transaction ID	M		9.2.1.62		–	
Criticality Diagnostics	O		9.2.1.17		YES	ignore

7.1.3.3 CELL SYNCHRONISATION INITIATION FAILURE

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	reject
Transaction ID	M		9.2.1.62		–	
Cause	M		9.2.1.6		YES	Ignore
Criticality Diagnostics	O		9.2.1.17		YES	Ignore

7.1.3.~~2~~4 CELL SYNCHRONISATION RECONFIGURATION REQUEST

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE Type and Reference~~	~~Semantics Description~~
~~Message Discriminator~~				
~~Message Type~~				
~~Transaction Id~~				
~~C-ID~~				
~~Common physical channel ID~~	~~M~~			
~~Cycles per SFN period~~	~~M~~			
~~Slots per SFN cycle~~	~~M~~			
~~**Cell Sync Burst Transmission Initiation**~~		~~0..1~~		
~~**>Cell Sync Burst Transmission Information**~~		~~1 .. <maxnoofTransmitslotspercycle>~~		
~~>>Slot number to transmit~~	~~M~~			
~~>>Cell Sync Burst Code~~	~~M~~			
~~>>Cell Sync Burst Code shift~~	~~M~~		~~INTEGER (0..7,..)~~	
~~>>DL transmission Power~~	~~O~~	~~DL Power~~		
~~**Cell Sync Burst Measurement Initiation**~~		~~0..1~~		
~~**>Cell Sync Burst Measurement Information**~~		~~1 .. <maxnoof Receiveslotspercycle>~~		
~~>>Slot number to receive~~	~~M~~			
~~**>>Cell Sync Burst Information**~~		~~1..<maxnoofreceptionsperSlot>~~		
~~>>Cell Sync Burst Code~~	~~M~~			
~~>>Cell Sync Burst Code shift~~	~~M~~		~~INTEGER (0..7,..)~~	
~~>Cell Sync Burst Report Type~~	~~M~~		~~ENUMERATED (Initial Phase, Steady-State Phase, Late-Entrant Cell, ..)~~	
~~>Synchronisation Report Characteristics~~	~~M~~			

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	reject
Transaction ID	M		9.2.1.62		–	
C-ID	M		9.2.1.9		YES	reject
Time Slot	M		9.2.3.23		YES	reject
Number of cycles per SFN period	M		9.2.3.7B		YES	reject

Number of repetitions per cycle period	M		9.2.3.7C		YES	reject
Cell Sync Burst Transmission Reconfiguration Information		0 .. < maxnoofCellSyncBursts >			Global	reject
>CSB Transmission ID	M		9.2.3.4N		–	
>Sync Frame number to transmit	M		Sync Frame number 9.2.3.18C		–	
>Cell Sync Burst Code	O		9.2.3.4G		–	
>Cell Sync Burst Code shift	O		9.2.3.4H		–	
>DL transmission Power	O		DL Power 9.2.1.21		–	
Cell Sync Burst Measurement Reconfiguration Information		0..1			YES	reject
>Cell Sync Burst Measurement Information		1 .. <maxnoofCellSyncBursts>			GLOBAL	reject
>>Sync Frame number to receive	M		Sync Frame number 9.2.3.18C		–	
>>Cell Sync Burst Information		1..< maxnoofreceptionsperSyncFrame>			–	
>>>CSB Measurement ID	M		9.2.3.4I		–	
>>>Cell Sync Burst Code	M		9.2.3.4G		–	
>>>Cell Sync Burst Code shift	M		9.2.3.4H		–	
>Synchronisation Report Type	O		9.2.3.18E		YES	reject
>Synchronisation Report Characteristics	O		9.2.3.18D		YES	reject

Range bound	Explanation
maxnoofCellSyncBursts	Maximum number of cell sync bursts per cycle
maxnoofreceptionsperSyncFrame	Maximum number of cell sync burst receptions per Sync Frame

7.1.3.5 CELL SYNCHRONISATION RECONFIGURATION RESPONSE

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	reject
Transaction ID	M		9.2.1.62		–	
Criticality Diagnostics	O		9.2.1.17		YES	ignore

7.1.3.6 CELL SYNCHRONISATION RECONFIGURATION FAILURE

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	reject
Transaction ID	M		9.2.1.62		–	
Cause	M		9.2.1.6		YES	Ignore
Criticality Diagnostics	O		9.2.1.17		YES	Ignore

7.1.3.~~3~~7 CELL SYNCHRONISATION REPORT

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE Type and Reference~~	~~Semantics Description~~
~~Message Discriminator~~				
~~Message Type~~				
~~Transaction Id~~				
~~**Cell Synchronisation Information**~~		~~*1..* <maxCellinNodeB>~~		
~~>C-ID~~	~~M~~			
~~>CHOICE *Cell Sync Burst Report Type*~~				
~~>>*Initial Phase*~~				
~~>>>CHOICE *Cell Sync Burst Availability Indicator*~~	~~M~~			
~~>>>>*Cell Sync Burst Available*~~				
~~>>>>>SFN~~	~~M~~			~~SFN number where cell sync burst has been received~~
~~>>>>>Cell Sync Burst Timing~~	~~M~~			
~~>>>>>Cell Sync Burst SIR~~	~~M~~			
~~>>>>*Cell Sync Burst not Available*~~			~~NULL~~	
~~>>*Steady State Phase*~~				
~~**>>>Cell Sync Burst Measured Information**~~		~~1 .. <maxnoofCellSyncBursts>~~		
~~>>>>Slot number~~	~~M~~			
~~**>>>>Cell Sync Burst Information**~~		~~1..<maxnoofreceptionsperSlot>~~		

~~>>>>>Cell Sync Burst Code~~	~~O~~			
~~>>>>>Cell Sync Burst Code shift~~	~~O~~			
~~>>>>>CHOICE *Cell Sync Burst Availability Indicator*~~	~~M~~			
~~>>>>>>*Cell Sync Burst Available*~~				
~~>>>>>>>Cell Sync Burst Timing~~	~~M~~			
~~>>>>>>>Cell Sync Burst SIR~~	~~M~~			
~~>>>>>>*Cell Sync Burst not Available*~~			~~NULL~~	
~~>>*Late-Entrant Cell*~~			~~NULL~~	

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	ignore
Transaction ID	M		9.2.1.62		–	
Cell Synchronisation Information		*1..* <maxCellinNodeB >			EACH	ignore
>C-ID	M		9.2.1.9		YES	ignore
>CHOICE *Synchronisation Report Type*					YES	ignore
>>*Initial Phase* or *Steady-State Phase*					–	
>>>Cell Sync Burst Measured Information		1 .. <maxnoofCellSyncBursts>			–	
>>>>SFN	M		9.2.1.53A		–	
>>>>Cell Sync Burst Information		1..<maxnoofreceptionsperSyncFrame>			–	
>>>>>CHOICE *Cell Sync Burst Availability Indicator*	M				–	
>>>>>>*Cell Sync Burst Available*					–	
>>>>>>>Cell Sync Burst Timing	M		9.2.3.4L		–	
>>>>>>>Cell Sync Burst SIR	M		9.2.3.4K		–	
>>>>>>*Cell Sync Burst not Available*			NULL		–	
>>*Late-Entrant Cell*			NULL		–	
>>*Frequency Acquisition*			NULL		–	

Range bound	Explanation
maxCellinNodeB	Maximum number of Cells in a Node B
maxnoofCellSyncBursts	Maximum number of cell sync bursts per cylce
maxnoofreceptionsperSyncFrame	Maximum number of cell sync burst receptions per Sync Frame

7.1.3.48 Synchronisation Report Characteristics

The Synchronisation Report Characteristics IE defines how the reporting on measured cell sync bursts shall be performed

Different methods shall apply for the measured cell sync burst reports. In the frequency acquisition phase the measurement report shall be sent when the frequency locking is completed. In the initial phase and for the measurement on late-entrant cells an immediate report after the measured frame is expected.

In the steady-state phase measurement reports may be given after every measured frame, after every SFN period or only when the requested threshold is exceeded.

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE Type and Reference~~	~~Semantics Description~~
~~Synchronisation Report Characteristics~~				
~~>Synchronisation Report characteristics type~~	~~M~~		~~ENUMERATED (Frame related, SFN period related, Threshold exceeding, ...)~~	~~Frame related – after every measured frame SFN period related – after every SFN period Threshold exceeding – when cell sync burst timing or SIR rises above the requested threshold~~
~~>Threshold exceeding~~	~~C-Threshold exceeding~~			~~Applies only to the Steady State Phase~~
~~>>Cell Sync Burst Threshold Information~~		~~1 .. <maxnoofCellSyncBursts>~~		
~~>>>Slot number to receive~~	~~M~~			
~~>>>>Cell Sync Burst Information~~		~~1..<maxnoofreceptionsperSlot>~~		
~~>>>Cell Sync Burst Code~~	~~M~~			
~~>>>Cell Sync Burst Code shift~~	~~M~~			
~~>>>Cell Sync Burst Arrival Time~~	~~M~~			~~Indicates the arrival time in synchronised mode~~
~~>>>Cell Sync Burst Timing Threshold~~	~~M~~			~~0: 0 chips 1: 0.125 chips 2: 0.25 chips ... The threshold variation for which the Node B shall trigger a Cell Synchronisation Report.~~

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Synchronisation Report	M		ENUMERAT	

characteristics type			ED (Frame related, SFN period related, Cycle length related, Threshold exceeding, Frequency Acquisition completed, ...)	
Threshold exceeding	C-Threshold exceeding			Applies only to the Steady State Phase
>Cell Sync Burst Threshold Information		1 .. <maxnoofCellSyncBursts>		
>>Sync Frame number to receive	M		Sync Frame number 9.2.3.18C	
>>Cell Sync Burst Information		1..<maxnoofreceptionsperSyncFrame>		
>>>Cell Sync Burst Code	M		9.2.3.4G	
>>>Cell Sync Burst Code shift	M		9.2.3.4H	
>>>Cell Sync Burst Arrival Time	O		Cell Sync Burst Timing 9.2.3.4L	
>>>Cell Sync Burst Timing Threshold	O		9.2.3.4M	

Range bound	Explanation
maxnoofCellSyncBursts	Maximum number of cell sync burst per cycle
maxnoofreceptionsperSyncFrame	Maximum number of cell sync burst receptions per Sync Frame

7.2 Synchronisation Adjustment

7.2.1 EP for Synchronisation Adjustment

Following Class 1 procedure shall be defined for Synchronisation Adjustment:

~~Elementary Procedure~~	~~Message~~	~~Successful Outcome~~	~~Unsuccessful Outcome~~	
		~~Response message~~	~~Response message~~	~~Timer~~
~~Synchronisation Adjustment~~	~~SYNCHRONISATION ADJUSTMENT REQUEST~~	~~SYNCHRONISATION ADJUSTMENT RESPONSE~~	~~SYNCHRONISATION ADJUSTMENT FAILURE~~	

Elementary Procedure	Message	Successful Outcome	Unsuccessful Outcome
		Response message	Response message
Synchronisation Adjustment	SYNCHRONISATION ADJUSTMENT REQUEST	SYNCHRONISATION ADJUSTMENT RESPONSE	SYNCHRONISATION ADJUSTMENT FAILURE

7.2.2 Synchronisation Adjustment procedure

The purpose of Synchronisation Adjustment procedure is to allow the CRNC to adjust the timing of the radio transmission of a cell within a Node B for time alignment.

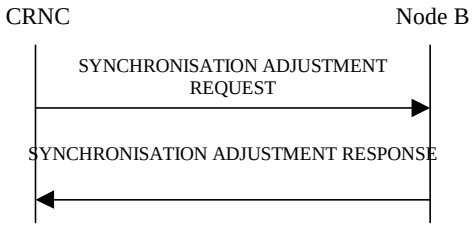

Figure 1: Synchronisation Adjustment – Successful Case

This procedure is initiated with a SYNCHRONISATION ADJUSTMENT REQUEST message sent by the CRNC to the Node B control port.

Upon reception, the Node B adjusts its timing according to the parameters given in the message. When the synchronisation adjustment is successfully done by the node B the node B shall respond with a SYNCHRONISATION ADJUSTMENT RESPONSE.

The Node B shall adjust its timing in the frame numbers in between two cell sync occations. If the SYNCHRONISATION ADJUSTMENT REQUEST message includes the *SFN* IE, the Node B shall use the indicated SFN as the starting number.

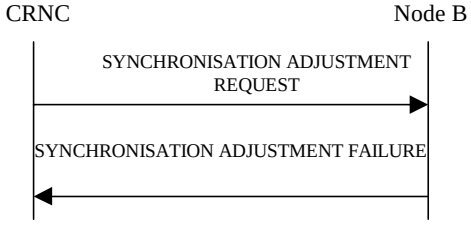

Figure 2: Synchronisation Adjustment – Unsuccessful Case

If the Node B cannot perform the indicated synchronisation adjustment due to hardware failure or other problem it shall send the SYNCHRONISATION ADJUSTMENT FAILURE as a response.

7.2.3 Synchronisation Adjustment message definitions

7.2.3.1 SYNCHRONISATION ADJUSTMENT REQUEST

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE type and reference~~	~~Semantics description~~
~~Message Discriminator~~	~~M~~			
~~Message Type~~	~~M~~			
~~Transaction ID~~	~~M~~			
~~C-ID~~	~~M~~			
~~Frame Adjustment value~~	~~O~~		~~INTEGER (0..4095)~~	~~SFN_{new}=(SFN_{old}+Frame Adjustment value) mod 4096~~
~~Timing Adjustment value~~	~~O~~		~~CHOICE INTEGER (0..511) or INTEGER (0..524288)~~	~~The first range is used within the Steady-State phase. The second range is used within the Initial phase when by the Timing Adjustment value the range of one radio frame has to be corrected.~~
~~DL Transmission Power~~	~~O~~			
~~SFN~~	~~O~~			~~Starting number in steady state when adjustment value shall apply~~
~~Transmit Burst Enabling~~	~~O~~		~~ENUMERATED (Enabled, Disabled)~~	

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	ignore
Transaction ID	M		9.2.1.62		–	
Cell Adjustment Information		1.. <maxCellinNodeB>			EACH	ignore
>C-ID	M		9.2.1.9		–	
>Frame Adjustment value	O		9.2.3.5C		–	
>Timing Adjustment value	O		9.2.3.22a		–	
>DL Transmission Power	O		9.2.1.21		–	
>SFN	O		9.2.1.53A		–	

Range bound	Explanation
MaxCellinNodeB	Maximum number of Cells in a Node B

7.2.3.2 SYNCHRONISATION ADJUSTMENT RESPONSE

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE type and reference~~	~~Semantics description~~
~~Message Discriminator~~	~~M~~			
~~Message Type~~	~~M~~			
~~Transaction ID~~	~~M~~			

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	ignore
Transaction ID	M		9.2.1.62		–	
Criticality Diagnostics	O		9.2.1.17		YES	Ignore

7.2.3.3 SYNCHRONISATION ADJUSTMENT FAILURE

~~IE/Group Name~~	~~Presence~~	~~Range~~	~~IE type and reference~~	~~Semantics description~~
~~Message Discriminator~~	~~M~~			
~~Message Type~~	~~M~~			
~~Transaction ID~~	~~M~~			
~~Cause~~	~~M~~			

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Discriminator	M		9.2.1.45		–	
Message Type	M		9.2.1.46		YES	ignore
Transaction ID	M		9.2.1.62		–	
CHOICE *cause level*	M				YES	ignore
>General					–	
>>Cause	M		9.2.1.6		–	
>Cell specific					–	
>>Unsuccessful Cell Information Response		1.. <maxCellinNodeB>			EACH	ignore
>>>C-ID	M		9.2.1.9		–	
>>>Cause	M		9.2.1.6		–	
Criticality Diagnostics	O		9.2.1.17		YES	Ignore

Range bound	Explanation
MaxCellinNodeB	Maximum number of Cells in a Node B