TSG-RAN Working Group 3 Meeting #7
Sophia Antipolis, France, Sept 20-24, 1999

TSGR3#7(99)C78

Agenda Item: **6.3**

Source: **Ericsson**

Title: **Radio synchronisation Timing diagram for 25.401**

Document for: **Decision**

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1 Introduction

The *Radio Synchronisation handling* part in the *Synchronisation issues model* (figure 8 in 25.401 V1.3.1) needs to be described.

The timing diagram in Figure 9 in TS 25.401 V1.2.1 on page 27 was deleted in V1.3.1. Too many old and wrong names and relations were used and described.

A new one is hereby presented. It contains a lot of details but is worth studying.

2 Discussion

A timing diagram that reflects the new frame number counters together with the used offsets, delays and time-instant relations is needed in ref [2].

The timing diagram should, together with some text, show:

- What are the sequences of CFN, BFN and SFN?
- What is the difference between BFN and SFN (definition of Tcell)?
- What are the references in source Node B (NB_1) and target Node B (NB_2)?
- What references are used and how to measure OFF and Tm at handover?

3 Proposal

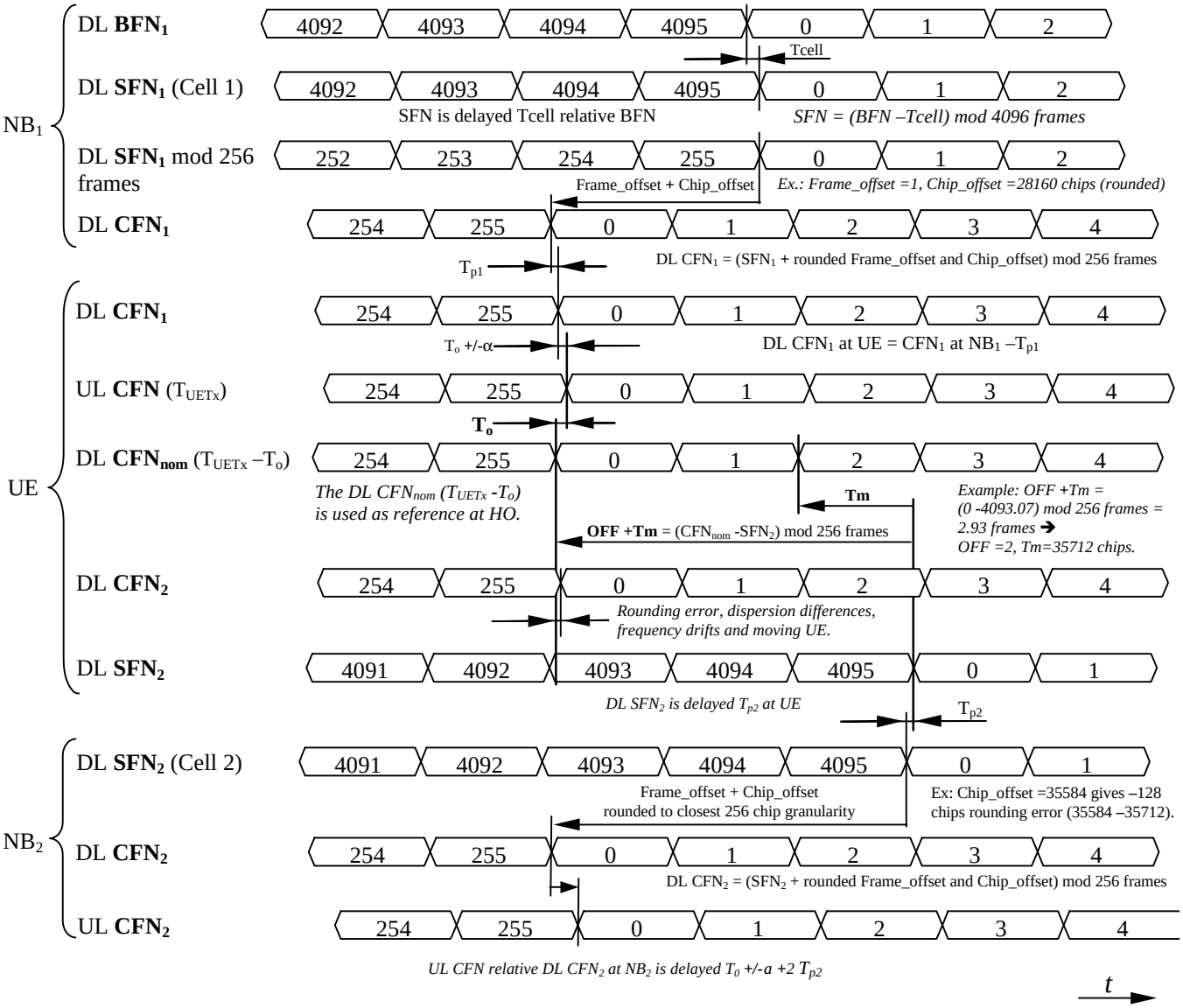
Four parts which are related to each other are proposed to be added or changed in ref [2]:

- New timing diagram with text
- How OFF and Tm are measured in UE
- Clarification in chapter 9.7.3.1, case 2
- Align the time reference name $T_{TX,UL}$ with the Layer 1 used T_{UETX}

3.1 New timing diagram with text

It is proposed that the new timing diagram with belonging text is placed in 25.401 in a chapter called “Radio Synchronisation handling timing diagram”.

The timing diagram shows an example with two cells connected to one UE where handover is done from source cell (Cell 1) to target cell (Cell 2).



α	1st received DL DPCH finger relative DL CFN_{nom}	T_{cell}	Specifies the SFN delay relative BFN
BFN	Node B Frame Number (counter)	T_m	Measured by UE at HO, the Tm has a range from 0 to 38399 chips.
CFN	Connection Frame Number (RL related)		
HO	Handover	T_o	Is a constant of 1024 chips, is the nominal difference between first received DPCH finger (DL CFN_{nom}) and T_{UETx} at UE.
NB_x	Node B (x=1:source, x=2:target)		
OFF	Offset with a range from 0 to 255 frames	T_{pX}	Propagation delay (one way), UE-Cell X
RFN	RNC Frame Number (counter)	T_{UETx}	The time when UE transmits an UL Dedicated Physical Channel.
RNC	Radio Network Controller		
SFN	System Frame Number (counter)		

Figure 1: Radio synchronisation timing diagram

SFN_1 is found in Cell 1 at NB_1 and SFN_2 at Cell 2 and NB_2. SFN_1 is sent T_{cell1} after the NB_1 reference BFN_1. CFN is the frame numbering for the frames in one radio link (RL). The UL CFN is sent from UE to both Cells (both NBs in this example). UL CFN at NB_2 is shown to indicate the difference to the DL CFN_2 at NB_2.

The new Radio Link which is setup at HO will face some deviation from nominal position due to e.g. Tm rounding to Chip offset, time tispersion, NB-UE frequency drift and UE movement.

Note: The frame number counters BFN, SFN and CFN are in the timing diagram seen as having a fractional part within each frame number in order to make it possible to express phase differences. Relations that can be positive or negative are expressed with a one-direction arrow. Delays, uncertainties and the constant To is expressed with bidirectional arrows. All time parameters are in expressions used with respective unit e.g. 10 ms and chips.

3.2 How OFF and Tm are measured in UE

It is proposed that the following lines are added in chapter 9.7.3:

In UE dedicated state, OFF and Tm are measured according to the following equation:

OFF + Tm = (T_{UETx} –T_o –SFN_{target}) mod 256 frames.

Example: assume that OFF + T_m equals "2.93" frames as shown in figure 1 as an example, then OFF = 2 and T_m = "0.93" which corresponds to T_m =35712 chips.

In other words (referring to figure 1):

- How to determine T_m: Select a time instant 1) where a frame starts at DL CFN_{nom} (=T_{UETx} –T_o) e.g. at frame number 2, the time from that time instant to the next frame border of DL SFN_2 at UE 2) equals T_m (if these are in phase with each other, T_m is zero).

- How to determine OFF: The difference between the frame number selected for time instant 1) and the frame number after time instant 2) mod 256 frames equals OFF. Example: (2 –0) mod 256 is 2, another example could be (254 –4092) mod 256.

3.3 Clarification in chapter 9.7.3.1, case 2

It is proposed that the following line is added in ref [2] after the present text in case 2 in chapter 9.7.3.1:

This could be seen as if a virtual dedicated CFN already is aligned with cell #1.

3.4 Align the time reference name $T_{TX,UL}$ with the Llayer 1 used T_{UETX}

It is proposed that the time reference name $T_{TX,UL}$ is aligned with what is used in Layer 1, which is using T_{UETx}.

Substitute all "$T_{TX,UL}$" in ref [2] to the alinged "T_{UETx}".

4 References

[1] 25.401 V1.2.1 - old, which contains the deleted old timing diagram
[2] 25.401 V1.3.1
[3] R1-99 844 - approved to have UE Tx as reference (even though Figure 1 is wrong, as no +/-α is included)
[4] R1-99C38 –approved that it should be possible to change the UE Tx timing with ¼ chip per 10 ms frame, the rounding error of +/-α is defined here, which is used in this timing diagram.