TSG-RAN Working Group 1 meeting #17 ***TSGR1#17(00)1268***

Stockholm, Sweden, November 21st – 24th, 2000

Agenda Item	**:** 1.28 Mcps TDD
Source	**:** Samsung Electronics Co., Ltd., Siemens AG, and CWTS
Title	**:** Propagation Delay Measurement in 1.28 Mcps UTRA TDD
Document for	**:** Discussion & Approval

1. Introduction

In FDD or 3.84 Mcps TDD, the propagation delay or round trip delay is measured by comparing the timing of the arrival of the PRACH and the boundary of the (access) timeslot. In 1.28 Mcps TDD, however, it is not possible to use the same mechanism to measure the propagation delay because of the unique frame structure and the uplink synchronization technique. To be more specific, the UE transmits the PRACH advanced in time so that the received PRACH by Node B is time alined with other codes in the same timeslot, and Node B does not know by how much time the UE transmitted the PRACH in advance. In this paper, we propose a means to measure the propagation delay in 1.28 Mcps UTRA TDD.

2. Uplink Synchronization Procedure

To measure the propagation delay, it is essential to understand the uplink synchronization procedure of 1.28 Mcps TDD. The synchronization procedure described in TR 25.928 is as follows.
First, a UE acquires downlink synchronization by using the DwPCH, and the propagation delay can be roughly estimated from the estimated path loss of DwPCH and/or P-CCPCH. Since the estimated path loss does not reflect the channel environment, the estimate of the propagation delay is not very accurate. Using this information, the UE aims to ensure that the UpPCH is received starting after the DwPCH and ending before the beginning of the first UL time slot at the NodeB. The sophistigated UEs can transmit UpPCH advanced in time by $UpPCH_{ADV}$ from the end of the 96 chip guard period, where $UpPCH_{ADV}$ can be determined, for example, based on the estimated propagation delay in which case approximately $UpPCH_{ADV}$ = 2?{estimated propagation delay}. This is to aim at the timeslot UpPTS. See figure 1 for an illustration. Since, $UpPCH_{ADV}$ can be obtained from the path loss, $UpPCH_{ADV}$ is not very accurate. For simple UEs the propagation delay is not estimated those can transmit their UpPCH immediately after the DwPCH. Furthermore, Node B measures the received starting position of the UpPCH denoted $UpPCH_{POS}$ in the figure. The reference time ($UpPCH_{POS}$ = 0) is two symbols prior to the end of the DwPCH. The received starting position of the UpPCH with respect to this reference $UpPCH_{POS}$ is sent to UE on FPACH, and UE adjusts its Tx timing of PRACH by $UpPCH_{POS}$. The definition of $UpPCH_{ADV}$ and $UpPCH_{POS}$ are as follows.

$UpPCH_{ADV}$: Difference between the Rx timing and initial Tx timing of a UE.
$UpPCH_{POS}$: Received starting position of the UpPCH. The reference time ($UpPCH_{POS}$ = 0) is two symbols prior to the end of the DwPCH. Any received starting position of the UpPCH after that point of time is positive.

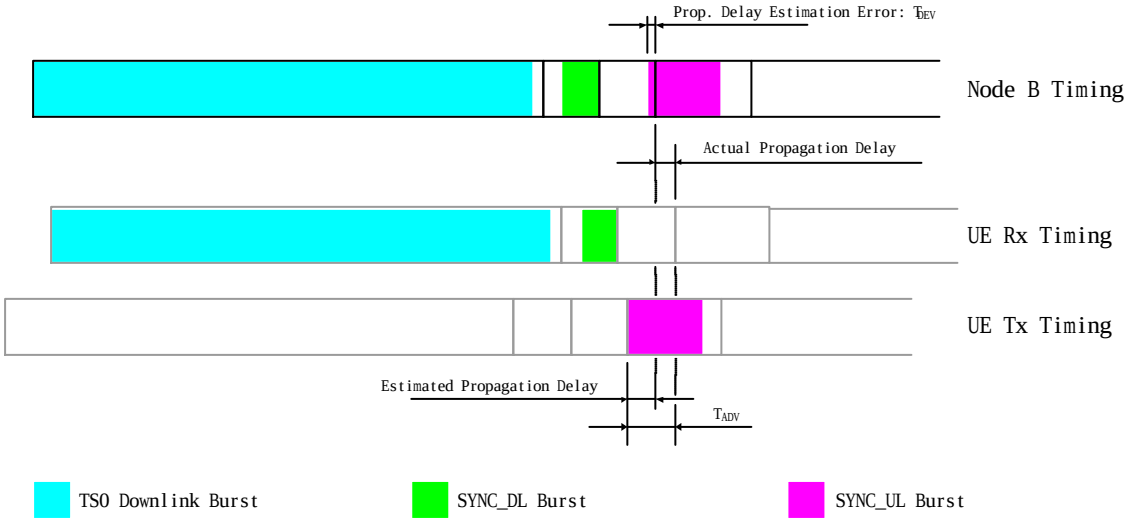

Figure 1. Timing of the UpPCH Transmission.

3. The Measurement of Propagation Delay

As shown in section 2, knowing the received timing of UpPCH or PRACH does not allow the Node B to measure the propagation delay, because the transmission timing of those physical channels are adjusted by the UE for uplink synchronization. Instead, the propagation delay can be calculated from $UpPCH_{ADV}$ and $UpPCH_{POS}$. Since, $UpPCH_{POS}$ is transmitted to UE on FPACH and $UpPCH_{ADV}$ is already known to the UE, the UE can calculate and transmit the propagation delay to the UTRAN in the message part of PRACH (higher layer signalling), where the propagation delay is defined by

$$\text{Propagation Delay} = (UpPCH_{ADV} - UpPCH_{POS} + 8*16\ T_C) / 2.$$

At the reception of the PRACH, UTRAN can calculate the remaining received time deviation with respect to is internal timing and use that information for further refinement of UE transmission timing.

4. Conclusion

In this paper, we propose a scheme to measure the propagation delay for 1.28 Mcps UTRA TDD. The proposed mechanism is different from those of FDD or 3.84 Mcps UTRA TDD because of the different frame structure and the use of uplink synchronization technique. In the proposed scheme, the UE obtains the measurement of the propagation delay from $UpPCH_{ADV}$ and $UpPCH_{POS}$. And it is transmitted to the UTRAN, where $UpPCH_{ADV}$ is the amount of time advance of Tx timing relative to the Rx timing and $UpPCH_{POS}$ is the propagation delay estimation error measured by the UTRAN.

References

[1] 3GPP TR 25.928: “1.28 Mcps Functionality for UTRA TDD Physical Layer”.

Contact_Points.doc

---------- Beginning of Text Proposal for working CR for 25.225 ----------

5 Measurement abilities for UTRA TDD

In this clause the physical layer measurements reported to higher layers. (this may also include UE internal measurements not reported over the air-interface) are defined.

5.1 UE measurement abilities

<This section is included in the working CR for completeness only. No changes will be made in this chapter.>

5.2 UTRAN measurement abilities

NOTE 1: If the UTRAN supports multiple frequency bands then the measurements apply for each frequency band individually.

NOTE 2: The RSCP can either be measured on the data part or the midamble of a burst, since there is no power offset between both. However, in order to have a common reference, the measurement on the midamble is assumed.

5.2.1 RSCP

<No changes will be made in this section.>

5.2.2 Timeslot ISCP

<No changes will be made in this section.>

5.2.3 RSSI

<No changes will be made in this section.>

5.2.4 SIR

<No changes will be made in this section.>

5.2.5 Transport channel BER

<No changes will be made in this section.>

5.2.6 Transmitted carrier power

<No changes will be made in this section.>

5.2.7 Transmitted code power

<No changes will be made in this section.>

5.2.8 RX Timing Deviation

<No changes will be made in this section except for the addition of the following sub-section.>

5.2.8.1 Received SYNC_UL Timing Deviation for 1.28 Mcps TDD

Definition	'Received SYNC_UL Timing Deviation' is the time difference $UpPCH_{POS} = UpPTS_{TS} - UpPTS_{Rxpath}$ in multiple of 1/8 chips, where $UpPTS_{Rxpath}$: time of the reception in the Node B of the SYNC_UL to be used in the uplink synchronization process $UpPTS_{TS}$: time instance two symbols prior to the end of the DwPCH according to the Node B internal timing UE can calculate Round Trip Time (RTT) towards the UTRAN after the reception of the FPACH containing $UpPCH_{POS}$ transmitted from the UTRAN. Round Trip Time RTT is defined by $RTT = UpPCH_{ADV} - UpPCH_{POS} + 8*16\ T_C$ Where $UpPCH_{ADV}$: the amount of time by which the transmission of UpPCH is advanced in time relative to the end of the guard period according to the UE Rx timing.

---------- End of Text Proposal for working CR for 25.225 ----------