3GPP TSG RAN WG3 *TSGR3#5(99)960*
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Title: Timing Advance for TDD

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1. Introduction

At the last RAN WG3 meeting, Timing Advance for TDD has been proposed [2], based on an earlier TSG RAN submission [1]. As a result, a Liaison Statement with questions to WG1 has been issued which has been answered [3]. The basic answer is that Timing Advance for TDD should best be performed by higher layers, not on Physical Layer. Summary: "The UE has to react on a timing advance command received via higher layer signaling by accordingly adjusting its transmit time. Appropriate step sizes for timing advance are shown in Section *'6.5 – Timing Advance'* of specification document TS25.224."

In RAN WG2, an updated concept has been presented recently [4]. This RAN WG3 contribution proposes the respective updates of RAN WG3 specs, in support of this Timing Advance concept.

2. Timing advance in case of access request on the RACH

When a UE uses the RACH for uplink transmission, Timing Advance is not applied. However, the Rx Timing Deviation of RACH bursts can be measured to give the starting value for Timing Advance after transition to another uplink channel, e.g. DCH or USCH.

Therefore, the first prerequisite for Timing Advance is that the NodeB measures the Rx timing deviation for received RACH bursts, and reports this to the RNC, together with the received RACH Transport Blocks.

To this end, the following upgrade of the RACH Iub Data Frame structure is suggested:

	Information element	**Description**
Header	Frame Type	Data Frame
	FN_{CELL}	Indicates the Cell Frame Number count when the RACH was received.
	Transport Format Indicator	The TFI to denote the format of the Transport Block set carrying the RACH payload.
Payload	Checksum indicator	Indicates if the transport block CRC is correct
	Transport Block 1	Data from the Radio interface
	Rx Timing Deviation 1 (option TDD)	Rx Timing error of Transport Block 1.
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	Checksum indicator	Indicates if the transport block CRC is correct
	Transport Block N	Data from the Radio interface
	Rx Timing Deviation N (option TDD)	Rx Timing error of Transport Block N.
Tail	Data frame checksum.	Checksum of the header and payload

(In this figure, the new Information Elements „Rx Timing Deviation i", for Transport Block i, has been introduced.)

Normally, it is sufficient if this Rx Timing Deviation measurement gets to the CRNC only, because during initial access, this is identical to the SRNC. However there are two cases where the Rx Deviation must be forwarded to the SRNC, over Iur:

a) During Cell update, if the CRNC is not the SRNC: In this case, the RNSAP message "
used to forward the access message to the SRNC. The Rx Timing Deviation measurement should be included with that message, to enable the SRNC to derive the correct Timing Advance value for the Channel Allocation message to the UE.

b) In the RACH/FACH state, when RACH/FACH over Iur is supported: In this case, DCCH frames are forwarded to the SRNC. The Rx Timing Deviation must be attached to that message.

3. Timing advance update while in DCH/DCH state

For timing advance in the DCH/DCH state, the concept is to use the NBAP "Dedicated Measurement" procedure, according [5], chapter 8.2.6. The CRNC orders the NodeB to monitor the Rx Timing for the Uplink part of a specific Radio Link. Once the Rx Timing exceeds a preconfigured threshold, NodeB reports the value to the CRNC, via NBAP. Probably, the measurement report should be repeated in case the deviation maintains.

CRNC shall forward this measurement report to the SRNC; then RRC in SRNC sends the Timing Advance command to the UE, as described in [4].

4. Timing advance update while in USCH/DSCH state

In this UE state, it is necessary that the Rx Timing Deviation of the received USCH bursts is measured by the NodeB, and reported to the CRNC.

This can be achieved by including a suitable Information Element in the Iub USCH Data Frame.

	Information element	**Description**
Header	Frame Type	Data Frame
	FN_{CELL}	Indicates the Cell Frame Number count when the USCH was received.
	Transport Format Indicator	The TFI to denote the format of the Transport Block set carrying the USCH payload.
Payload	Transport Block Set	Data from the Radio interface
	Rx Timing Deviation (option for TDD)	Reports the measured Rx Timing Deviation of the UL bursts (TDD)
Tail	Data frame checksum.	Checksum of the header and payload

Proposal for Iub USCH Data Frame structure.

Since in the "Standalone" USCH scenario, the NodeB does not know which UE currently uses the USCH, the NodeB can not send a Dedicated Measurements Report as NBAP message to the RRC. A "Common Measurement" will not be sufficient because the timing association between the received USCH Transport Block, and the Rx Timing Deviation, can not be reported sufficiently accurate. Therefore it is proposed to include the Rx Timing Deviation within the Iub USCH Data Frame.

The measured Timing Deviation can be evaluated in the CRNC by the USCH scheduler (MAC-sh), or by another entity. This is discussed in [4].

5. Proposal

It is proposed to include the above specified RACH and USCH Iub Data Frame structures, including the Rx Timing Deviation Information Element, into the Iub Common Transport Channel specification [6].

References:

[1] 3GPP TSG RAN Tdoc RP-99357, Timing advance for TDD, Source: Siemens
[2] 3GPP TSG RAN WG3 Tdoc R3-99604, Timing Advance for TDD, Source: Siemens
[3] 3GPP TSG RAN WG3 Tdoc R3-99827, Answer from WG1 to LS from WG3 on Timing Advance for TDD
[4] 3GPP TSG RAN WG2 Tdoc R2-99849, Description of the Timing Advance Mechanism for TDD, (Siemens)
[5] 3GPP TS 25.433 v.1.1.2, NBAP specification.
[6] 3GPP TS 25.435 v.0.3.1, Iub user plane protocols for Common Transport Channel data streams.