TSG-RAN Working Group 1 Meeting #14
Oulu, Finland, July 4-7, 2000

TSGR1#14(00)096

Source: **InterDigital Comm. Corp.**

Title: **Synchronization of Timing Advance and Timing Deviation Measurement**

Agenda Item: **AdHoc 99**

Document for: **Decision**

Introduction:

The UL delay estimation at NodeB is used to determine UE location. This measurement must be correlated with the UE's current timing advance to calculate the actual UL propagation delay. It is also beneficial to know the exact frame TA will take effect so that TA failures can be quickly recovered and layer three signalling overhead can be reduced.

Discussion:

In the TDD Physical Layer Procedures specification (25.224 revision 3.3.0) it is stated that "Upon receiving the TA command the UE shall adjust its transmission timing according to the timing advance command at the beginning of the next frame that fulfils the SFN Mod20 = 0 criteria and which does not occur sooner than 10 frames after the TTI period for the DCCH carrying the timing advance command ended.". This delayed and periodic updating is intended to allow for coordination of the UE's Timing Advance (TA) and the NodeB's Timing Deviation (TD) measurement, and to support impulse response averaging.

This method of scheduling TA adjustments in the UE so that TD measurements in NodeB can be correlated with the absolute TA for the frame being measured is problematic. The duration of the 200ms period (SFN mod 20 = 0) and 10 frame DCCH reception delay is intended to allow for the TA signalling to complete. This is difficult to accomplish since it requires the S-RNC, Node-B and UE be in phase with respect to this TA adjustment cycle. If the S-RNC initiates the procedure too early the previous TA period is used and if the S-RNC is too late the current TA period is missed and the adjustment will be performed in the following cycle.

In order for the TA adjustment to occur on the correct period the S-RNC will need to delay generation of TA commands until processing in the UE for previous period has expired. This scheduling in the RNC is further complicated by varying propagation delays, especially in the Cell FACH case.

The proposed solution is for the S-RNC to explicitly specify the SFN the UE transmission will be adjusted in the TA command. Additionally, it is proposed that all Node-B TD measurements reported to the RNC specify the SFN the measurement was recorded during. This allows for the S-RNC to specify the moment of TA adjustment based on the estimated time of arrival at the UE without having to take into account a set periodic interval and associated delay. In addition to co-ordinating the TA adjustment and TD measurement for location services, It also provides the ability for the S-RNC to verify the TA adjustment was performed correctly to determine if either retransmission of the TA command is needed or if further adjustment is necessary.

In order not to effect the Node-B physical layer impulse response averaging function Node-B is also informed by the S-RNC of the SFN the TA adjustment will take place. This allows the possibility to support a sliding window that takes into account the TA adjustment within the averaging period, rather then only allowing continuous repetitive period averaging. This ability always exists in the UE.

3GPP TSG RAN WG1 Meeting #14
Oulu, Finland, July 4th –7th, 2000

Document R1-000963
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 25.224	CR	026	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#9	For approval	X	Strategic		(for SMG use only)
list expected approval meeting # here ↑		For information		Non-strategic		

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

Source: InterDigital Comm. Corp. **Date:** 06/07/00

Subject: Synchronisation of Timing Advance adjustment and Timing Deviation measurement

Work item:

Category: *(only one category Shall be marked With an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: The UL delay estimation at NodeB is used to determine UE location. This measurement must be correlated with the UE's current timing advance to calculate the actual UL propagation delay. It is also beneficial to know the exact frame TA will take effect so that TA failures can be quickly recovered and layer three signalling overhead can be reduced.

Clauses affected: 4.3

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:

4.3 Timing Advance

UTRAN may adjust the UE transmission timing with timing advance. The initial value for timing advance will be determined in the UTRAN by measurement of the timing of the PRACH. The required timing advance will be represented as an 6 bit number (0-63) being the multiple of 4 chips which is nearest to the required timing advance.

When Timing Advance is used the UTRAN will continuously measure the timing of a transmission from the UE and send the necessary timing advance value. On receipt of this value the UE shall adjust the timing of its transmissions accordingly in steps of ±4chips. The transmission of TA values is done by means of higher layer messages. Upon receiving the TA command the UE shall adjust its transmission timing according to the timing advance command at the frame number specified by higher layer signaling. ~~beginning of the next frame that fulfils the SFN Mod20 = 0 criteria and which does not occur sooner than 10 frames after the TTI period for the DCCH carrying the timing advance command ended.~~ The UE is signaled the TA value in advance of the specified frame activation time to allow for local processing of the command and application of the TA adjustment on the specified frame. Node-B is also signaled the TA value and radio frame number the TA adjustment will take place in order to allow for impulse response averaging and the possibility to support a sliding window approach.

When TDD to TDD handover takes place the UE shall transmit in the new cell with timing advance TA adjusted by the relative timing difference Δt between the new and the old cell:

$$TA_{new} = TA_{old} + 2\Delta t$$