TSG-RAN Working Group 1 meeting #9 **TSGR1#9(99)j41**
Dresden, Germany
November 30 – December 3, 1999

Agenda item: AH 16

Source: Ericsson

Title: CR 25.215-007r01: Ranges and resolution of timing measurements

Document for: Decision

1. Introduction

This CR is a revised version of the CR in R1-99i73. In the attached CR in this contribution the definition of the measurement "Observed time difference to GSM cell" has been aligned with the proposal in R1-99i69.

The aim of this document is to define ranges for some timing measurements in TS 25.215.

2. UE Rx-Tx time difference and Round trip time

In figure 1 the internal timing in the UE is shown. The UE is in soft handover with 3 radio links in the active set, indexed i, j and k in the figure.

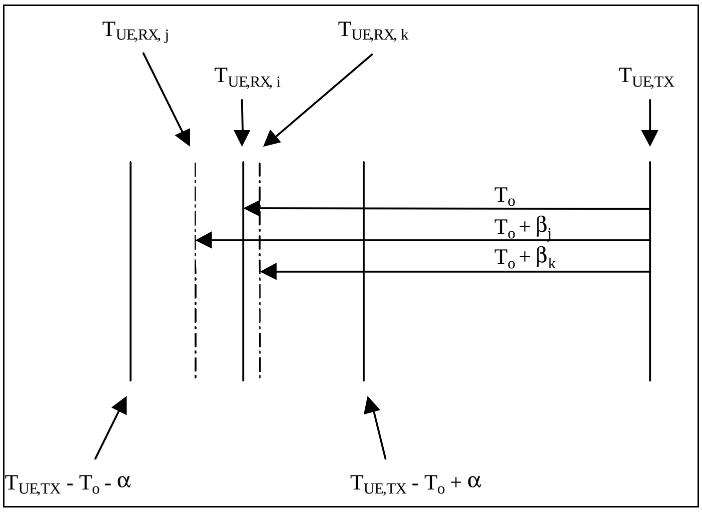

Figure 1 UE internal timing

The receiving window in the UE is set to 2α where α=(128+20)=148 chips, see TS 25.214 section 4.3.3. The UE Rx-Tx timing is defined as the difference in time between the $T_{UE,Tx}$ and the time for reception of the donwlink frame from the cells in the active set, e.g.: T_{UETx} - T_{UERx}, where:

T_{UETx} is the time when the UE transmits an uplink DPCCH/DPDCH frame.
T_{UERx} is the time when the first significant path of the downlink DPCH frame from the measured radio link is received in the UE.
T_0 is defined in TS 25.211 section 7.1.3 and equals 1024 chips.

The UE Rx-Tx time difference will therefore always be within the interval $To \pm \alpha$.

As the UE Rx-Tx time difference is intended to be used for positioning applications and taking into account that the SFN-SFN observed time difference type 2 has a resolution of ½ chip, it is proposed that this is valid also for the UE Rx-Tx time difference measurement.

- The UE Rx-Tx time difference is given with the resolution of ½ chip with the range [876, …, 1172] chips.

The UTRAN Round trip time (RTT) measurement will basically measure: (2*propoagation delay + UE Rx-Tx time difference). The lower bound for the measurement will be determined by assuming a propagation delay of zero, which gives RTT=876.

The upper boundary will be set by the maximum cell radius that we would like to support by the measurement. At some cell radius the 1-slot delay power control loop will be impossible to maintain but that issue is not treated here.

In the table below the maximum cell radius that is possible to estimate using different number of bits to map the RTT measurement on is shown. It is proposed that the RTT also is measured with ½ chip resolution.

Number of bits for RTT	**Upper limit for RTT (assuming lower limit is 876 chips)**	**Maximum cell radius**
10	1387.5 chips	8.4 km
11	1899.5 chips	28.4 km
12	2923.5 chips	68.4 km

It is proposed that 12 bits is used for the RTT measurement, which will lead to the possibility to represent propagation delays corresponding to a cell radius of up to 68.4 km.

- The Round trip time is given with the resolution of ½ chip with the range [876, …, 2923.5] chips.

3. Observed time difference to GSM cell

The measurement of “Observed time difference to GSM cell” is shown in figure 1.

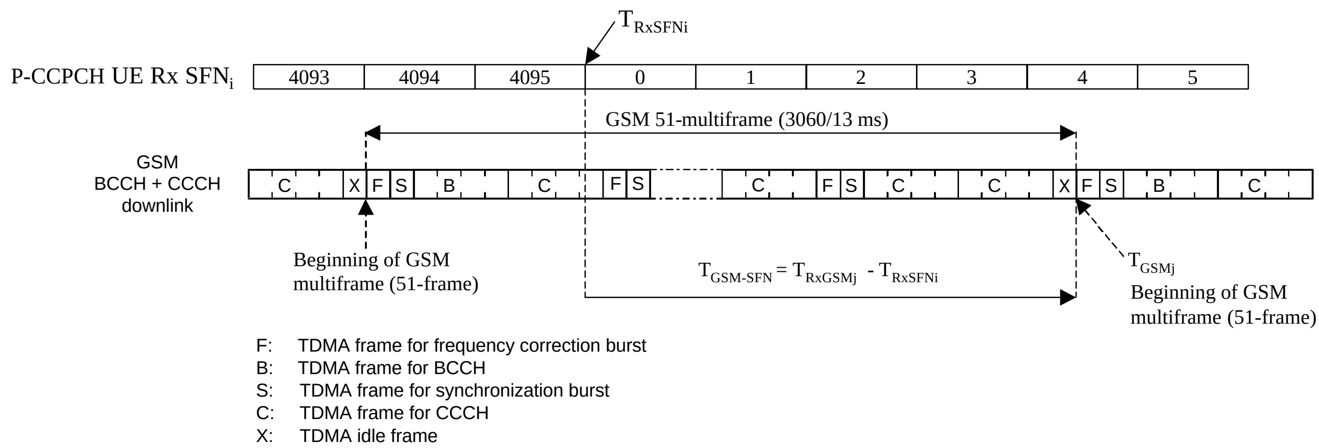

Figure 2 Measuring the “Observed time difference to GSM cell

As the GSM 51-multiframe structure is repeated every 51 GSM frames, the upper range for the measurement is one multiframe, e.g. 3060/13 ms. One possible usage of the measurement is to position the CM-pattern for measuring on GSM cells. As positioning is made in entire slots an upper limit of the resolution could be something like half a slot ~ 1/3 ms. There could be gain by being able to schedule the measurements with a finer resolution if several GSM-cells shall be measured within a TGL. A resolution of 1/13ms ≈ 76.9 µs (approx. 0.13 GSM slots) will give 3060 values of the timing measurement, requiring 12 bits. With 12 bits 4096 values can be represented and therefore it is proposed to divide the range of the measurement into 4096 intervals corresponding to a resolution of 3060/(4096*13) ms ≈ 57.5 µs (approx. 0.1 GSM-slot).

The Observed time difference to GSM cell is given with the resolution of 3060/(4096*13) ms with the range [0, …, 3060/13-3060/(4096*13)] ms.

3GPP TSG RAN WG1 Meeting #9
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Document ??99???
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.

25.215 CR 007r01 Current Version: 3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #6	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: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Ericsson **Date:** 1999-11-24

Subject: Ranges and resolution of timing measurements

Work item:

Category:
(only one category shall be marked with an X)

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

Reason for change: Define range and resolution for three timing measurements in TS 25.215, namely UE Rx-Tx time difference, Round trip time and Observed time difference to GSM cell.

Clauses affected: 5.1 UE measurement abilities
5.2.7 Round trip time

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:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

5.1.11 CFN-SFN observed time difference

Definition	The CFN-SFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= T_{RxSFN} - (T_{UETx}-T_0), given in chip units with the range [0, 1, …, 38399] chips T_{UETx} is the time when the UE transmits an uplink DPCCH/DPDCH frame. T_0 is defined in TS 25.211 section 7.1.3. T_{RxSFN} is time at the beginning of the next received neighbouring P-CCPCH frame after the time instant T_{UETx}-T_0in the UE. If the next neighbouring P-CCPCH frame is received exactly at T_{UETx}-T_0 then T_{RxSFN}=T_{UETx}-T_0 (which leads to T_m=0). and OFF=(CFN_{Tx}-SFN) mod 256, given in number of frames with the range [0, 1, …, 255] frames CFN_{Tx} is the connection frame number for the UE transmission of an uplink DPCCH/DPDCH frame at the time T_{UETx}. SFN = the system frame number for the neighbouring P-CCPCH frame received in the UE at the time T_{RxSFN}.
Applicable for	Connected Inter, Connected Intra
Range/mapping	Time difference is given with the resolution of one chip with the range [0, …, 9830399] chips.

5.1.12 SFN-SFN observed time difference

Definition	**Type 1:** The SFN-SFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= T_{RxSFNj} - T_{RxSFNi}, given in chip units with the range [0, 1, …, 38399] chips T_{RxSFNj} is the time at the beginning of a received neighbouring P-CCPCH frame from cell j. T_{RxSFNi} is time at the beginning of the next received neighbouring P-CCPCH frame from cell i after the time instant T_{RxSFNj} in the UE. If the next neighbouring P-CCPCH frame is received exactly at T_{RxSFNj} then T_{RxSFNj}= T_{RxSFNi} (which leads to T_m=0). and OFF=(SFN_j- SFN_i) mod 256, given in number of frames with the range [0, 1, …, 255] frames SFN_j = the system frame number for downlink P-CCPCH frame from cell j in the UE at the time T_{RxSFNj}. SFN_i = the system frame number for the P-CCPCH frame from cell i received in the UE at the time T_{RxSFNi}. **Type 2:** The relative timing difference between cell j and cell i, defined as $T_{CPICHRxj}$ - $T_{CPICHRxi}$, where: $T_{CPICHRxj}$ is the time when the UE receives one CPICH slot from cell j $T_{CPICHRxi}$ is the time when the UE receives the CPICH slot from cell i that is closest in time to the CPICH slot received from cell j
Applicable for	**Type 1:** Idle, Connected Intra **Type 2:** Idle, Connected Intra, Connected Inter
Range/mapping	**Type 1:** Time difference is given with a resolution of one chip with the range [0, …, 9830399] chips. **Type 2:** Time difference is given with a resolution of 0.5 chip with the range [-1279, …, 1280] chips.

5.1.13 UE Rx-Tx time difference

Definition	The difference in time between the UE uplink DPCCH/DPDCH frame transmission and the first significant path, of the downlink DPCH frame from the measured radio link. Measurement shall be made for each cell included in the active set. Note: The definition of "first significant path" needs further elaboration.
Applicable for	Connected Intra
Range/mapping	~~Always positive.~~The UE Rx-Tx time difference is given with the resolution of ½ chip with the range [876, …, 1172] chips.

5.1.15 Observed time difference to GSM cell

Definition	The Observed time difference to GSM cell is defined as: $T_{RxGSMj} - T_{RxSFNi}$, where: T_{RxSFNi} is the time at the beginning of the P-CCPCH frame with SFN=0 from cell i. T_{RxGSMj} is the time at the beginning of the GSM BCCH 51-multiframe from GSM frequency j received closest in time after the time T_{RxSFNi}. If the next GSM multiframe is received exactly at T_{RxSFNi} then $T_{RxGSMj} = T_{RxSFNi}$ (which leads to $T_{RxGSMj} - T_{RxSFNi} = 0$). The timing measurement shall reflect the timing situation when the most recent (in time) P-CCPCH with SFN=0 was received in the UE.
Applicable for	Idle, Connected Inter
Range/mapping	The Observed time difference to GSM cell is given with the resolution of 3060/(4096*13) ms with the range [0, …, 3060/13-3060/(4096*13)] ms.

5.2 UTRAN measurement abilities

The structure of the table defining a UTRAN measurement quantity is shown below:

Column field	**Comment**
Definition	Contains the definition of the measurement.
Range/mapping	Gives the range and mapping to bits for the measurements quantity.

5.2.1 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the UTRAN uplink carrier channel bandwidth in an UTRAN access point. The reference point for the RSSI measurements shall be the antenna connector.
Range/mapping	

5.2.2 SIR

Definition	Signal to Interference Ratio, is defined as the RSCP divided by the ISCP. Measurement shall be performed on the DPCCH after RL combination in Node B. The reference point for the SIR measurements shall be the antenna connector.
Range/mapping	

5.2.3 Transmitted carrier power

Definition	Transmitted carrier power, is the total transmitted power on one carrier from one UTRAN access point. Measurement shall be possible on any carrier transmitted from the UTRAN access point. The reference point for the total transmitted power measurement shall be the antenna connector. In case of Tx diversity the total transmitted power for each branch shall be measured.
Range/mapping	

5.2.4 Transmitted code power

Definition	Transmitted code power, is the transmitted power on one carrier, one scrambling code and one channelisation code. Measurement shall be possible on any channelisation code transmitted from the UTRAN access point. The reference point for the transmitted code power measurement shall be the antenna connector. In case of Tx diversity the transmitted code power for each branch shall be measured.
Range/mapping	

5.2.5 Transport channel BLER

Definition	Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC on each transport block. Measurement shall be possible to perform on any transport channel after RL combination in Node B. BLER estimation is only required for transport channels containing CRC.
Range/mapping	

5.2.6 Physical channel BER

Definition	The physical channel BER is an estimation of the average bit error rate (BER) before channel decoding of the DPDCH data after RL combination in Node B. It shall be possible to report a physical channel BER estimate at the end of each TTI for the transferred TrCh's, e.g. for TrCh's with a TTI of x ms a x ms averaged physical channel BER shall be possible to report every x ms.
Range/mapping	

5.2.7 Round trip time

Note: The relation between this measurement and the TOA measurement defined by WG2 needs clarification.

Definition	Round trip time (RTT), is defined as RTT = $T_{RX} - T_{TX}$, where T_{TX} = The time of transmission of the beginning of a downlink DPCH frame to a UE. T_{RX} = The time of reception of the beginning (the first significant path) of the corresponding uplink DPCCH/DPDCH frame from the UE. Note: The definition of "first significant path" needs further elaboration. Measurement shall be possible on DPCH for each RL transmitted from an UTRAN access point and DPDCH/DPCCH for each RL received in the same UTRAN access point.
Range/mapping	The Round trip time is given with the resolution of ½ chip with the range [876, …, 2923.5] chips.