TSG-RAN Meeting #14 **TSGRP#14(01) 0867**
Kyoto, Japan, 11 - 14, December, 2001

Title: **Agreed CRs to TS 25.850**

Source: **TSG-RAN WG3**

Agenda item: **8.3.3/8.3.4/9.4.3**

RP Tdoc	R3 Tdoc	Spec	CR_N	Rev	Release	CR_Subject	C	Cur_Ve	New_Ve	Workitem
RP-010867	R3-013174	25.850	003		Rel-4	UTRAN SFN-SFN Observed Time difference measurement report mapping and accuracy definition	F	4.2.0	4.3.0	LCS1-UEPos-IubIur

3GPP TSG-RAN3 Meeting #24 **_R3-013174_**
Makuhari, Japan, 26th – 30th November 2001

CR-Form-v3

CHANGE REQUEST

⌘	**25.850**	**CR**	**003**	⌘ rev	**-**	⌘ Current version:	**4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM [ ] ME/UE [ ] Radio Access Network [X] Core Network [ ]

Title: ⌘	UTRAN SFN-SFN Observed Time difference measurement report mapping and accuracy definition		
Source: ⌘	R-WG3		
Work item code: ⌘	LCS1-UEPos-IubIur	***Date:*** ⌘	November 2001
Category: ⌘	**F**	***Release:*** ⌘	REL-4
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ⌘	The UTRAN SFN-SFN Observed Time difference mapping and accuracy is listed as a open item in the TR. There is also numerous places in the TR, where only a working assumption is taken for UTRAN SFN-SFN Observed Time difference mapping and accuracy definition. Since the report mapping and accuracy for UTRAN SFN-SFN Observed Time difference is specified in TS25.123 and TS25.133 v. 4.2.0, the open item related to UTRAN SFN-SFN Observed Time difference mapping and accuracy is removed and reference is made for theses specifications for UTRAN SFN-SFN Observed Time difference mapping and accuracy.
Summary of change: ⌘	Open item related to UTRAN SFN-SFN Observed Time difference mapping and accuracy is removed. Reference is made for TS25.123 and TS25.133 for UTRAN SFN-SFN Observed Time difference mapping and accuracy.
Consequences if not approved: ⌘	If this CR is not approved, the concerned open item still remains in the TR. Impact Analysis: Impact assessment towards the previous version of the specification (same release): This CR has no impact with the previous version of the specification because this CR only removes the open item from the TR related to accuracy and report mapping of UTRAN SFN-SFN Observed Time Difference, that is now defined in appropriate specifications TS25.123 and TS25.133 and then referred in NBAP and RNSAP specifications.

Clauses affected:	⌘	6.2, 7.2		
Other specs affected:	⌘	☐	Other core specifications	⌘
		☐	Test specifications	
		☐	O&M Specifications	
Other comments:	⌘			

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6.2 OTDOA Radio Interface Timing

The general principle of the OTDOA method is to use two different types of information:

- Propagation Delay,
- Difference between the propagation delays of signals transmitted by different Node Bs

The first type of information can only be determined using [FDD - Round Trip Time]/[TDD – Rx Timing Deviation] measurements in UTRAN and [FDD - Rx-Tx Time Difference measurements in the UE]. These [FDD - Round Trip Time]/[TDD – Rx Timing Deviation] measurements can only be performed by Node Bs controlling cells in the Active Set. This leads to very low number of measurements for the purpose of UE Positioning.

The second type of information that be determined is the difference between the propagation delays of signals transmitted by different Node Bs. In this case, this measurement is not limited to Node Bs controlling cells in the Active Set of the considered UE. In order to determine this information the UE performs SFN-SFN Observed Time Difference measurements. However, since the Network is not necessarily synchronised, the frame boundaries of signals may not be simultaneously transmitted by the different Node Bs. Similarly, the frames with the same SFN are not necessarily transmitted simultaneously by two different Node Bs. Then, it is necessary to determine the Relative Time Difference (RTD) which is the difference between the instants of emission of radio frames by the different Node Bs. This information necessary to the position calculation function is determined by the SRNC. It is then stored in the case of the UE-assisted method or sent to the UE in the case of the UE-based method. This Relative Time Difference can be determined using either *UTRAN GPS Timing of Cell Frames for LCS* measurements or *SFN-SFN Observed Time Difference* measurements in UTRAN (see [5] and [6]):

- *UTRAN GPS Timing of Cell Frames for LCS*: In this case, each Node B is requested to perform the $T_{UTRAN\text{-}GPS}$ measurement for the specified cell and reports it to the SRNC. The SRNC determines the Relative Time Difference by considering the measurements for the concerned cells as well as the SFN at which they have been performed.
- *SFN-SFN Observed Time Difference*: In this case, a Node B is requested to perform the SFN-SFN Observed Time Difference measurement between the specified signal received from another Node B and its own signal (identified by the Reference Cell ID). All the relevant information must be transmitted to the Node B concerning the signal to be received. This measurement is transmitted to SRNC. This measurement can be performed during Idle Periods (IPDL) if necessary. On the basis of this measurement and of the knowledge of the Geographical Position of the Node Bs (allowing to compute an estimation of the propagation delay between the two Node Bs), it is possible to determine the Relative Time Difference.

The following section concentrates on the functions in the Node Bs and in the SRNC pertaining to this UE Positioning method.

In this document the terms $T_{UTRAN\text{-}GPS}$ and SFN-SFN are used, in order to make the text easier to read.

$T_{UTRAN\text{-}GPS}$ = UTRAN GPS Timing of Cell Frame for LCS as specified in [5] and [6].

SFN-SFN = SFN-SFN Observed Time Difference as ~~to be~~ specified in [5] and [6].

The measured SFN-SFN observed time difference values shall be reported to the SRNC. The quality of the measured SFN-SFN value may also be reported ~~(especially if there is no accuracy specified in [7] and [8])~~. It shall be used in the SRNC to evaluate the reliability of the reported value. Since the SFN-SFN will change slowly with the time, SFN-SFN drift rate together with its quality shall be reported as well.

The measured $T_{UTRAN\text{-}GPS}$ shall be reported to the SRNC. The quality of measured $T_{UTRAN\text{-}GPS}$ may also be reported (especially if there is no accuracy specified in [7] and [8]). It shall be used in the SRNC to evaluate the reliability of the reported value. Since the $T_{UTRAN\text{-}GPS}$ will change in almost the same manner as time, $T_{UTRAN\text{-}GPS}$ drift rate with its quality shall be reported as well.

The usefulness of the non-zero time derivative (drift rate) of $T_{UTRAN\text{-}GPS}$ (even after compensating the effect of elapsed time) and SFN-SFN values is the unstability of Node B clocks. In the case of SFN-SFN, its time derivative (or drift rate) is eventually determined by the clock stabilities of Node Bs between which the SFN-SFN is measured. In the case of $T_{UTRAN-GPS}$, the additional drift rate is coming from the clock stability of the measured Node B.

When the Node B clock stability requirement is 0.05 ppm, it means that in the worst case the SFN-SFN value might change with the drift rate 0.1 ppm (one Node B is drifting 0.05 ppm to one direction while the other is drifting 0.05 ppm to another direction). Thus SFN-SFN drift rate might be as high as 30 m/s. For $T_{UTRAN-GPS}$ the worst case is 0.05 ppm drift rate, i.e. 15 m/s.

Expected location accuracy of OTDOA-IPDL can be rather high. For example location accuracy of 14 meters in suburban and 35 m in Urban B environments. Assuming SFN-SFN drift rate to be 30 m/s, even 1 second old SFN-SFN values (i.e. SFN-SFN information is 1 second older than OTDOA measurements from the UE) might be 30 m wrong. The hyperbola between two Node Bs (on which the UE should be) is defined by the Geometric Time Difference GTD = OTDOA- SFN-SFN. Thus 30 m error in SFN-SFN means (depending on geometry) at least 30 m location error, i.e. in suburban environment the error might increase 3 times.

Quality merits of $T_{UTRAN-GPS}$ and SFN-SFN measurements and their drift rates, i.e. standard deviations, are needed in the SRNC for two major reasons:

- They are used for weighting different measurements in order to increase accuracy. Due to physical nature of $T_{UTRAN-GPS}$ and SFN-SFN measurements, there will be better and worse measurements. For location calculation information about reliability of measurements is of utmost importance.

- They are used to estimate the confidence area for the location estimate. Reference [9] defines a set of confidence areas (area within which the real location is with a certain probability).

If quality numbers are not available location accuracy decreases and confidence area determination is not possible.

6.2.1 Iub Interface

Iub is required to transmit requests for measurements from the CRNC to a Node B and measurement results from a Node B to the CRNC. SFN-SFN and $T_{UTRAN-GPS}$ measurements may be done on demand, periodically or when there are significant changes in measurement value.

It is most feasible to introduce SFN-SFN and $T_{UTRAN-GPS}$ measurements to the existing measurements on Common Resources functionality using following EPs in NBAP:

a) Common Measurement Initiation,

b) Common Measurement Reporting,

c) Common Measurement Termination, and

d) Common Measurement Failure.

Measurement initiation for radio interface timing measurements (Common Measurement Initiation)

The request for radio interface timing information $T_{UTRAN-GPS}$ or SFN-SFN from the CRNC to a cell in the Node B shall contain the following parameters:

- Measurement type;

- In case of SFN-SFN, instruction about reference cell used as reference for measurements;

- In case of SFN-SFN, instructions about neighbouring cells to be measured;

- Introduction of how the measurement shall be reported (on demand, periodic or on modification);

- In case of TUTRAN-GPS measurement the minimum required accuracy class for TUTRAN-GPS measurement

Measurement type

In the measurement type info CRNC indicates whether it wants its cell to perform TUTRAN-GPS or SFN-SFN measurements.

If requested measurement type is TUTRAN-GPS, the cell shall measure the UTRAN GPS Timing of Cell Frames for LCS as defined in reference [5] and [6].

If requested measurement type is SFN-SFN, the cell shall measure the SFN-SFN Observed Time Difference between the reception of the signal sent by the measured neighbour cells and its own signal. To allow a better reception of the signal of other Node Bs, idle periods (IPDL) can be used as specified in [5] and [6].

Reference cell

Cell [FDD - containing the primary CPICH] that is used as a reference for SFN-SFN measurements is identified with its C-Id IE. In case of TUTRAN-GPS measurement C-Id IE identifies the cell where the TUTRAN-GPSis to be measured.

Neighbouring cells to be measured

In FDD mode of operation the neighbouring cells to be measured for SFN-SFN are identified with UC-Id IE. This list shall also contain the information on the neighbouring cell CPICH signal i.e. UARFCN IE and Primary Scrambling Code IE.

The maximum number for measured neighbouring cell in FDD mode of operation is 96 as specified in reference [7] for UE.

In TDD mode of operation the neighbouring cells to be measured for SFN-SFN are identified with *UC-ID* IE. This list of measured neighbouring TDD cells shall contain *UARFCN* IE and *Cell Parameter Id* IE to indicate the cell information. Since the measurement can be performed on every slot position on individual burst types and midambles, *Time slot* IE and *Midamble shift and burst type* IE shall be contained in addition.

The maximum number for measured neighbouring cell in TDD mode of operation is 96 as specified in reference [8].

There is also open item to clarify whether GSM cells can be used as additional neighbouring cells for UE positioning purpose.

Report Characteristics

Introduction of how the measurement shall be reported shall contain the information about how the measurement shall be done. Measurements can be made on demand or periodically. However, existing report criteria event A to F are not applicable for TUTRAN-GPS and SFN-SFN and a new report criteria on-modification should be defined.

In On modification type of report criteria the Node B shall report the results of measurements immediately and then initiate measurement reporting according to the following triggers:

- Change of the TUTRAN-GPS compared to previously reported value at the initial Common Measurement Reporting or at Common Measurement Reporting when the event was triggered.
- Deviation of the actual measurement received from physical layer from the predicted TUTRAN-GPS value.
- Change of the SFN-SFN compared to previously reported value (either in the initial Common Measurement Initiation procedure or at the Common Measurement Reporting when the event was triggered).
- Deviation of the actual measurement received from physical layer from the predicted SFN SFN value.

1. In the first case above, the change of the TUTRAN-GPS means that timing relation between the UTRAN SFN and GPS TOW has been changed due to the clock drift of the Node B. The criteria for such a trigger is defined according to following:

   The change of TUTRAN-GPS value after n measurements is calculated according to the following formula:

   $Fn = Fn, n\text{-}1 + Fn\text{-}_1$ *(1)*

   Where the F_n and F_{n-1} are the accumulated change after n and n-1 measurement periods respectively and the $F_{n,\ n-1}$ is the drift during the last measurement period.

   The $F_{n,\ n-1}$ is derived according to the following:

   $$F_{n,\ n-1} = M_n - M_{n,\ estimated} = M_n - (M_{n-1} + 10ms*((SFN_n - SFN_{n-1}) \bmod 4096))$$
   $$= (M_n - M_{n-1}) - 10 * ((SFN_n - SFN_{n-1}) \bmod 4096) \qquad (2)$$

   Where:

M_n and M_{n-1} are the actual measurements of the $T_{UTRAN-GPS}$ received from the physical layer at SFN_n and SFN_{n-1} respectively.

$M_{n,\ estimated}$ is the estimated $T_{UTRAN-GPS}$ at SFN_n which is equal to previous measurement M_{n-1} plus the period between the two measurements.

The *mod (4096)* deals with the fact that the range for SFN is [0..4095].

Inserting (2) in (1), adding the modulo operation to the SFN and M differences, and converting the 10 ms into 1/16 chip unit which is the measurement resolution defined TS 25.133, then the drift F_n can be expressed by following formula:

$$F_n = (M_n - M_{n-1}) \bmod 37158912000000 - ((SFN_n - SFN_{n-1}) \bmod 4096) *10*3.84*10\verb|^|3*16 + F_{n-1} \text{ [1/16 chip]} \quad (3)$$

If the Reporting *Report Characteristics* IE is set to 'On Modification', the Node B reports the result of the requested measurement immediately and afterwards the Node B initiates a Common Measurement Reporting procedure every time the absolute value of the F_n rises above the indicated threshold. After each reporting the n is set to zero and the calculation is restarted.

2. The second case above is based on the assumption that the drift rate (1^{st} derivative) of the Node B internal clock is nearly constant within a period of the time. The drift rate is reported in the measurement report to the CRNC. The Node B and CRNC will periodically make a prediction and update the timing internally resulting in that the amount of signalling due to the measurement reporting is reduced. However if the predicted value deviates from the actual measured value in Node B by more than the indicated threshold, the event is triggered and the new $T_{UTRAN-GPS}$ value and drift rate are reported to the CRNC. The calculation of the predicted value and the deviation is according to the following:

$P_n=b$ *for n=0*

$P_n = ((1+a) * ((SFN_n - SFN_{n-1}) \bmod 4096) *10*3.84*10\verb|^|3*16 + P_{n-1}) \bmod 37158912000000$ *for n>0*

$F_n = \min(abs(M_n - P_n), abs(M_n - P_n - 37158912000000), abs(M_n - P_n + 37158912000000))$ *for n>0*

Where:

P_n is the predicted $T_{UTRAN-GPS}$ value when n measurement results has been received after first Common Measurement Reporting at initiation or after the last event was triggered.

F_n is the calculated deviation of the predicated from measurement result and predicted value. All these values are present to take care of the fact the range of $T_{UTRAN-GPS}$ measurement is [0.. 37158911999999]. Furthermore, these values imply that the specified threshold shall never exceed 18579456000000 (=37158912000000/2).

a is the last reported $T_{UTRAN-GPS}$ Drift Rate value.

b is the last reported $T_{UTRAN-GPS}$ value.

abs is the absolute value.

The reason for having the factor (1+a) is to compensate for the fact that the GPS TOW is a counter that is stepped up regularly. Please see the mapping in the 25.133.

At each measurement result received from physical layer, the P_n and F_n are calculated and if F_n rises above the indicated threshold the event is triggered, n is set to zero and the calculation is restarted.

3. For the third case, this similar to the first case except that the SFN-SFN measurement does not evolve with time, so the change of the value is handled as follows:

$F_n=0$ *for n=0*

$F_n = (M_n - a)) \bmod 40960$ *for n>0*

Where:

F_n is the change of the SFN-SFN value expressed in unit [1/16 chip] when n measurement results have been received from the Layer 1 after first Common Measurement Reporting at initiation or after the last event was triggered.

a is the last reported SFN-SFN value.

The *mod 40960* takes care of the fact that the SFN-SFN Observed Time Difference UTRAN measurement has been defined on Time Slot Boundaries (range between –1280 and +1280 chips with a resolution of $1/16^{th}$ of chip).

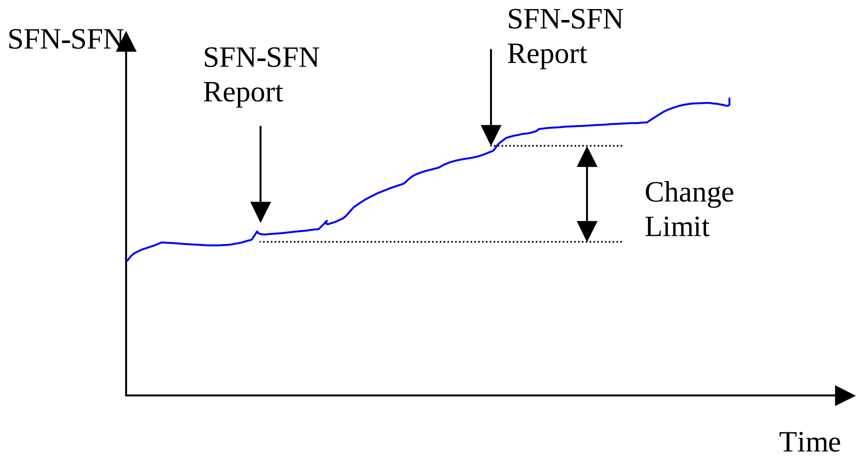

Figure 1: Change Limit based report criteria

4. Similarly, for the fourth case, above the predicted SFN-SFN value and the deviation are described according to the following:

   $P_n = ((\, a * (15*((SFN_n – SFN_{n-1}) \bmod 4096) + (TS_n – TS_{n-1}))*2560*16+ P_{n-1}) \bmod 40960) – 20480 \quad for \quad n>0$

   $F_n = min(abs(M_n – P_n), abs(M_n – P_n – 40960), abs(M_n – P_n + 40960)) \quad for\ n>0$

   Where:

   P_n is the predicted *SFN-SFN* value when n measurement results have been received from Layer 1 after first Common Measurement Reporting at initiation or after the last event was triggered. The modulo are present for the same reason as stated above, furthermore the -20480 at the end of the equation takes care of the fact that the $T_{UTRAN-GPS}$ measurement is between –1280 and +1280 chip with a granularity of 1/16th of chip.

   a is the last reported SFN-SFN Drift Rate value.

   b is the last reported SFN-SFN value.

   F_n is the deviation of the last measurement result from the predicted SFN-SFN value (P_n) when n measurements have been received from Layer 1 after first Common Measurement Reporting at initiation or after the last event was triggered. All these values are present to take care of the fact the $T_{UTRAN-GPS}$ measurement is between –1280 and +1280 chip with a granularity of 1/16th of chip. Furthermore, these values imply that the specified threshold shall never exceed 20480 (=40960/2).

   M_n is the latest measurement result received from the physical layer measurements, measured at the Time Slot TS_n of the Frame SFN_n.

   If the Fn rises above the threshold the event is triggered and the new SFN-SFN value and SFN-SFN Drift rate are reported to CRNC.

   Furthermore, the SFN-SFN Drift rate or the $T_{UTRAN-GPS}$ Drift Rate will always be reported to the CRNC. These drift rates are not a measurement but are determined by the Node B. However, it is assumed that the determination of the drift rate is rather an implementation issue. In a simple Node B implementation, the drift rate may be set to zero or a fixed value based on the characteristics of the internal clock, while in other implementation a more advanced method may be deployed to determine the drift rate. Therefore, no specific way of determining it can be mandated.

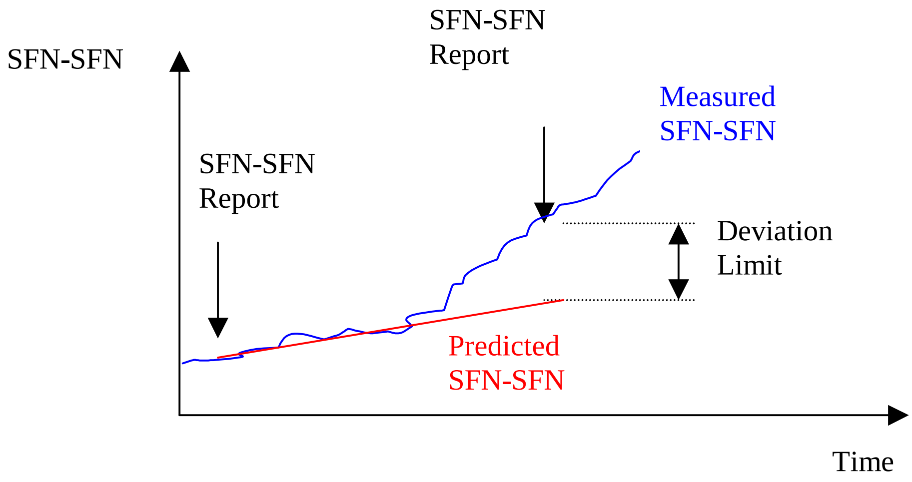

Figure 2: Deviation based Report Criteria

Minimum required accuracy class for $T_{UTRAN-GPS}$ measurement

For $T_{UTRAN-GPS}$, different accuracy classes are needed to be specified for UTRAN GPS Timing of Cell Frames for LCS measurements in reference [7] and [8]. In the case where $T_{UTRAN-GPS}$ measurement is required for OTDOA it shall be indicated in the report initialisation with the minimum accuracy class required for OTDOA purpose. The response and report message shall then contain the achieved accuracy class.

Measurement report for radio interface timing measurements (Common Measurement Initiation successfully case and Common Measurement Reporting)

Measurement report for $T_{UTRAN-GPS}$ measurement or SFN-SFN measurements from a cell in the Node B to the CRNC shall contain the following information:

- Identity of measured cell for $T_{UTRAN-GPS}$ or reference cell used for SFN-SFN measurement
- In case of $T_{UTRAN-GPS}$ measurement, $T_{UTRAN-GPS}$ of measured cell;
- In case of $T_{UTRAN-GPS}$ measurement, quality of reported $T_{UTRAN-GPS}$;
- In case of $T_{UTRAN-GPS}$ measurement, $T_{UTRAN-GPS}$ drift rate;
- In case of $T_{UTRAN-GPS}$ measurement, quality of reported $T_{UTRAN-GPS}$ drift rate;
- In case of $T_{UTRAN-GPS}$, achieved accuracy class of the $T_{UTRAN-GPS}$ measurement;
- In case of SFN-SFN measurement, identity of measured neighbour cells;
- In case of SFN-SFN measurement, SFN-SFN between reference cell and measured neighbouring cells;
- In case of SFN-SFN measurement, quality of reported SFN-SFN;
- In case of SFN-SFN measurement, SFN-SFN drift rate;
- In case of SFN-SFN measurement, quality of reported SFN-SFN drift rate;
- In case of $T_{UTRAN-GPS}$ and SFN-SFN measurement SFN as a time when the measurement is reported by the layer 3 filter

Identity of measured cell for $T_{UTRAN-GPS}$ or reference cell used for SFN-SFN measurement

Measurement Id in measurement response- or measurement report message is used to implicitly identify the cell used for $T_{UTRAN-GPS}$ measurement or the reference cell used for SFN-SFN measurements.

$T_{UTRAN-GPS}$ of measured cell

$T_{UTRAN-GPS}$ contains the UTRAN GPS Timing of Cell Frames for LCS as specified in reference [7] and [8].

Quality of reported $T_{UTRAN-GPS}$

$T_{UTRAN-GPS}$ Quality is the quality of reported $T_{UTRAN-GPS}$ value that can be used to evaluate the reliability of reported value in the SRNC and to define the confidence area for the position estimate. This quality is the standard deviation (Std) of reported reference cell $T_{UTRAN-GPS}$.

$T_{UTRAN-GPS}$ Drift Rate

$T_{UTRAN-GPS}$ drift rate is needed in the SRNC position calculation function's position estimate to evaluate the evolution of $T_{UTRAN-GPS}$ due the Node B clock drift.

$T_{UTRAN-GPS}$ drift range indicates the first time derivative of the reported AT value. It is the best estimate of $T_{UTRAN-GPS}$ drift rate at the time of last $T_{UTRAN-GPS}$ measurement.

Quality of reported $T_{UTRAN-GPS}$ Drift Rate

$T_{UTRAN-GPS}$ drift rate quality is the quality of reported $T_{UTRAN-GPS}$ drift rate that can be used to evaluate the reliability of reported drift rate in the SRNC. This quality is the standard deviation (Std) of reported reference cell $T_{UTRAN-GPS}$ drift rate.

Accuracy class of $T_{UTRAN-GPS}$ measurement

This field contains the achieved accuracy class for $T_{UTRAN-GPS}$ measurement that is to be specified in reference [7] and [8].

Identity of measured neighbour cells

In case of SFN-SFN measurement the measured neighbours are identified with *UC-Id* IE in the measurement response and measurement report messages.

SFN-SFN between reference cell and measured neighbouring cell

SFN-SFN shall contain the reported SFN-SFN Observed time difference according to report mapping ~~to be~~ specified in~~for~~ reference [7] and [8].

Quality of reported SFN-SFN

SFN-SFN Quality is the quality of reported SFN-SFN value that can be used to evaluate the reliability of SFN-SFN measurements in the SRNC and to define the confidence area for the position estimate. This quality is the standard deviation (Std) of reported SFN-SFN value.

SFN-SFN Drift Rate

SFN-SFN drift rate is used in the SRNC to evaluate the evolution of SFN-SFN due the frequency difference and jitter between cells in the Node Bs.

SFN-SFN drift rate indicates the first time derivative of the SFN-SFN value between reference cell transmission and the reception of neighbouring cell signal. It is the best estimate of the SFN-SFN drift rate value at the time of last SFN-SFN measurement.

Quality of reported SFN-SFN drift rate

Quality of reported SFN-SFN drift rate is the quality of reported SFN-SFN drift rate that can be used to evaluate the reliability of reported SFN-SFN drift rate in the SRNC. This quality is the standard deviation (Std) of reported SFN-SFN drift rate.

SFN Reporting

In the case of the $T_{UTRAN-GPS}$ measurement, it is necessary to have the SFN reported in order to identify on which frame the measurement has been performed (otherwise the ambiguity on the SFN cannot be resolved when considering measurements for different cells in the SRNC).

In the case of the SFN-SFN Measurement, it is necessary to have the SFN and the TS reported in order to identify on which slot boundary the measurement has been performed. This should allow resolving the ambiguity by taking into account the SFN-SFN Observed Time Difference measurement performed by the UE and the fact that an ambiguity of Time Slot is equivalent to an ambiguity of 200 km on the position.

Failure cases

If the cell cannot initialise the request $T_{UTRAN-GPS}$or SFN-SFN measurement the Node B shall response with COMMON MEASUREMENT INITIATION FAILURE message with the failure cause value 'Measurement not supported for the object'.

If the measurement were requested on demand and failure occurs due the lack of GPS TOW in case of $T_{UTRAN-GPS}$ measurement or hear ability problem of all the neighbouring cells the Node B shall initiate the Common Measurement failure procedure.

If the required measurement can be initiated by the cell (periodic, on modification) but a temporary failure occurs due to the lack of GPS TOW (in case of $T_{UTRAN-GPS}$ measurement) or the lack of hear ability of all the neighbouring Cells (SFN-SFN) the Node B shall respond with the COMMON MEASUREMENT REPORT message with the Common Measurement value 'Measurement not Available'.

If there is no measurement available for the neighbour cell that shall be measured (SFN-SFN) this is indicated in the list of unsuccessfully measured neighbour cell information in the *Common Measurement value* IE.

There shall be also failure cases for the situation where SFN-SFN measurements are initialised without information of neighbouring cells or $T_{UTRAN-GPS}$ measurement is initialised without measurement minimum accuracy requirement or AT/SFN-SFN measurement are initialised without FN reporting required.

6.2.2 Iur Interface

Since the measurements may be requested (by the SRNC) from a Node B whose CRNC is not the SRNC, then the Iur must allow transmitting requests for measurements to another RNC and measurement results from another RNC to the SRNC. As such there is a need for the functionality of Measurement on Common Resources in RNSAP (similar to the NBAP functionality). These ‘Common Measurement Procedures’ over Iur shall offer the same functionality as the procedures within Iub with regard to the OTDOA UE Positioning Method.

6.2.3 Open items

Following open items are identified:

~~1) Mapping and accuracy of the SFN-SFN Observed Time Difference UTRAN measurement. Is there a need to report the accuracy of this measurement?~~

1) Accuracy of the $T_{UTRAN-GPS}$ UTRAN measurement.

~~2) Accuracy of the $T_{UTRAN-GPS}$ UTRAN measurement.~~

7 Agreements and associated contributions

7.1 Architecture

It is agreed to map the UTRAN UP functions to UTRAN elements SRNC, CRNC, DRNC and Node B as described in the chapter 6.1. It is also agreed that the information described in chapter 6.1 is needed to be conveyed between CRNC and Node B over the Iub as the part of NBAP procedures and between the CRNC/DRNC and SRNC as part of RNSAP procedures.

7.2 OTDOA Radio Interface Timing

For OTDOA Radio Interface timing following agreements have been made:

- OTDOA Radio Interface Timing measurements SFN-SFN and $T_{UTRAN-GPS}$ need to be introduced as new measurements to the existing measurements on Common Resources functionality in NBAP and new on Common Resources functionality in RNSAP with high similarity to NBAP.
- General names used for radio interface measurements SFN-SFN and $T_{UTRAN-GPS}$ shall have the following meaning:
    - $T_{UTRAN-GPS}$ measurement is the UTRAN GPS Timing of Cell Frames for LCS as specified in [5] and [6]
    - SFN-SFN measurement is the UTRAN SFN-SFN Observed Time difference as ~~to be~~ specified in [5] and [6]. ~~Working assumption is that the SFN-SFN Observed Time difference is defined as in LS-R1-(01)-0147.~~

~~- Working assumption is that the SFN-SFN Observed Time Difference values are between –20980 and +20979. It needs to be confirmed by RAN4 specification.~~

- Common Measurement Initiation (REQUEST message) for radio interface timing measurements (Common Measurement Initiation) shall incorporate the information described in chapter 6.2.1 i.e.:
    - Information about neighbouring cells to be measured for SFN-SFN measurements
    - New Report Characteristics 'On Modifications' including
        - $T_{UTRAN-GPS}$ Change Limit
        - Predicted $T_{UTRAN-GPS}$ Deviation Limit
        - SFN-SFN Change Limit
        - Predicted SFN-SFN Deviation Limit
    - Minimum required accuracy class for $T_{UTRAN-GPS}$ measurement according to mapping in [7] and [8]. For OTDOA method the minimum accuracy class C shall be used
- Common Measurement report for radio interface timing measurements (Common Measurement successful case and Common Measurement Reporting) shall be incorporate the information described in chapter 6.2.i .e.:
    - $T_{UTRAN-GPS}$ measurement
        - $T_{UTRAN-GPS}$ of measured cell according to mapping in [7] and [8]
        - Quality of reported $T_{UTRAN-GPS}$
        - $T_{UTRAN-GPS}$ Drift Rate
        - Quality of reported $T_{UTRAN-GPS}$ Drift Rate
        - Accuracy class of $T_{UTRAN-GPS}$ measurement according to mapping in [7] and [8]. This shall be present in the RESPONSE message only. Class C is the minimum requirement for OTDOA method

- SFN as a time stamp when the measurement was made
- UC-Id as Identity of measured neighbour cells

- SFN-SFN Observed Time Difference measurements:
  - SFN-SFN between reference cell and measured neighbouring cell according to the Working Assumption above.
  - Quality of reported SFN-SFN
  - SFN-SFN Drift Rate
  - Quality of reported SFN-SFN drift rate
  - Reference cell SFN + Timeslot of Reference cell as a timestamp of the SFN-SFN measurements

- Determining of drift rates and quality figures are seen as a implementation issues. These figures can be set to fixed values (especially since ~~if for instance~~ the accuracy of the SFN-SFN Observed Time Difference UTRAN measurement is specified by RAN4) or determined by some advanced method.
- SFN-SFN measurements from the neighbouring cells are grouped in case of on-demand periodic measurements
- If the report criteria is event trigger based (SFN-SFN measurement) only the particular neighbouring cell measurement that triggers the event is reported
- Common Measurement Failure and Common Measurement Initiation unsuccessful case shall be modified to include the information as described in chapter 6.2.2 for unsuccessful cases.
- It has also been agreed to use the new set of Information Exchange Procedure (see 7.7 for details) to transmit the geographical coordinates of the Node B antenna transmitting on a cell (UTRAN Access Point Coordinates) to an RNC that does not control this Node B.