TSG-RAN Working Group 4 (Radio)
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Title: **Requirements for handover in 25.103**

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1 Introduction

This contribution discusses the requirements that have to be set for the UE behaviour when performing different kinds of handover. An outline of these requirements for FDD handovers within UTRAN is proposed to be included into 25.103 [1].

2 Discussion

2.1 General

There are several different types of handover and this paper only discusses handover within UTRAN FDD, performed with the RRC procedures *handover command* and *active set update*.
When performing a handover or addition/deletion of radio links to a specific UE there are several requirements on both the network and the UE behaviour. Since, the controlling of network nodes from the RNC, such as measurements to be performed and when to add a radio link on the network side, only is related to implementation of the RNC; this paper focuses mainly on the UE requirements.
Also what measurements the UE should perform in order to support the handover decision is related to the handover strategy chosen by the operator and the RNC manufacturer.

In the protocol specifications of WG2 the procedure behaviour is intended to only describe the UE part, what the UE shall do in a given situation and what timers trigger different actions in the UE. The UTRAN behaviour is to be left out of the protocol specification. However, in order to get proper protocol behaviour some implicit UTRAN timers is stated through the requirements on the UE.
These requirements on the UE should be specified in 25.103 through e.g. delay requirements for specific UE actions.

In chapter 3 the UE requirements regarding handover has been elaborated to be inline with the current description of handover procedures in other 3GPP Working Groups.

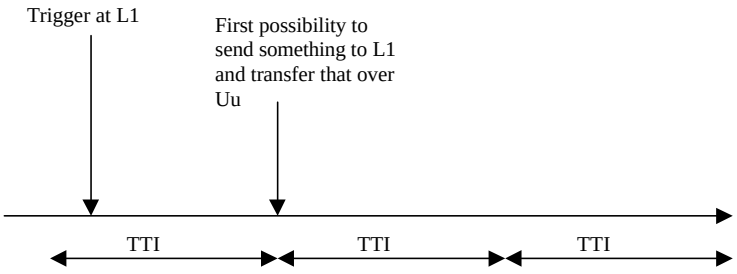
General changes done:

- The chapters 6.1.3.1.1.5 *Frame offset Measurement Accuracy* and 6.1.3.2.1.3 *Frame offset Measurement Accuracy* has been moved to the measurement chapter 18 and is included through the CFN-SFN subchapter.
- The general requirements in 6.1.2 have been taken into account through the time requirements in the chapter 6.1.3 to 6.1.4 instead of using a bullet list.
- The “Quick detection of degradation of link quality” bullet should be achieved in the RRC Connection supervision requirements and the usage of RRC connection re-establishment procedure, and could therefor also be removed.
- The RF parameters sub chapters should be removed since its assumed contents are very unclear.

2.2 FDD Soft/Softer Handover

The requirements for this procedure should be the time the UE has to perform the action requested in the RRC message. There should also be statements on the possibility for the UE to perform several actions in parallel.

The measurement reporting delay is dependent on the transmission time interval for the signalling (DCCH). This is because if the DCCH is mapped to a transport channel with TTI 80 ms this in average causes an extra delay of 40 ms for the report, since the UE has to wait until the next occasion data is delivered to L1 for that transport channel.



For the delay allowed to perform an active set update there are two different cases. The first case is that the UE gets a new cell in that active set update message that the UE is currently monitoring for measurements, i.e. one could assume that the UE has good knowledge about the timing for that cell.

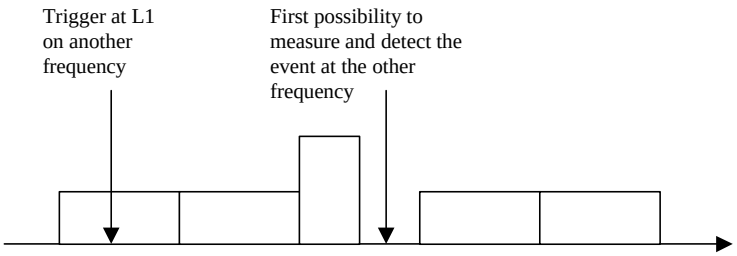
The second case is that the UE gets a cell in the active set update message that the UE are not performing measurements on at the moment. This will require the UE to first find the cell before being able to use it.

To see that a UE really uses a radio link one could design a test case for this with the inner loop power control, and see that the UE starts to use the TPC bits from the new cells.

2.3 FDD Hard handover

Since, the RRC procedure “handover command” used for inter-frequency handover also is used to do hard handover from one frequency to the same frequency; it is proposed that the subchapter is renamed to “FDD Hard Handover” instead.

The requirements for the UE support of hard handover are quite similar to the FDD soft/softer requirements. The main difference is that measurements on another frequency require compressed mode. Because of this the requirements are dependent on the available measurement slots created with compressed mode. E.g. a certain event on another frequency can not be detected until the UE has the opportunity to measure it.



Also for the hard handover case the two cases where the UE is aware of a cell through measurements or not applies.

3 Proposed text to 25.103

6.1 Handover

6.1.1 Introduction

The ~~overall~~ handover process ~~shall~~ should be implemented in both the UE and ~~RNS~~UTRAN. The UE measurements and which radio links the UE shall use is controlled by UTRAN with RRC signalling.
Measurements are specified in TS25.215 and UE behaviour in response to UTRAN RRC messages is described in TS25.331.~~Measurement of serving radio connection downlink performance and candidate cells received signal strengths and quality must be made in the UE. These measurements shall be signalled to the RNS for assessment. The RNS measures the uplink performance for the UE being served. The RNC uses measurements in conjunction with defined thresholds and handover strategy to make a handover decision.~~

~~*6.1.2 Requirements*~~

~~The reliability of handover in all its different forms is essential to the successful operation of a network. In performing handover preparation and execution the minimum requirements shall be:~~

- Quick detection of candidate cells
- Quick synchronisation to candidate cells
- Reporting of sufficient number of candidate cells
- Quick detection of degradation of link quality
- Reliable measurement procedures of serving and target cells
- Reliable and quick reporting mechanisms
- Reliable synchronisation mechanism
- Quick and safe release of resource
- Safe guards for failed handoffs
- Minimal disruption to service
- Minimal degradation to link quality
- Minimal degradation to other users
- Full Flexibility and efficiency to seamlessly handle the spectrum in a multi-operator scenario

6.1.23 Handover 3G to 3G

6.1.23.1 FDD Soft/Softer Handover

The soft handover procedure is initiated from UTRAN with an active set update message.*[The requirements presented in these sections will be reviewed depending on the further progress in TSG RAN WG1 and TSG RAN WG2]*

6.1.23.1.1 Requirements

6.1.23.1.1.1 Maximum number of cells to be monitored

For soft handover purposes, tThe UE shall be capable of simultaneously measureingmonitoring the CPICH of at least [FFS] neighboring cells given in a measurement control message(s).the neighbor cell list. The exact number of cells to be monitored will be determined by the used soft handover strategy/algorithm.

6.1.23.1.1.2 Measurement reporting delay

The measurement reporting delay is defined as the time from when a report is triggered at the physical layer according to the event or periodic mechanism set to trigger the measurement report, until the UE tries to transmit the measurement report over the Uu interface.it takes to report a measurement to the decision entity. For soft handover purposesall possible events defined in the measurement control messages as intra-frequency measurement reporting criteria, the measurement reporting delay shall not exceed [FFS] seconds the time stated in the table below.

TTI for DCCH carrying measurement report [ms]	Maximum measurement reporting delay [ms]
10	
20	
40	
80	

6.1.23.1.1.3 Active set dimension

The active set is defined as set of radio links simultaneously involved in a specific communication service between an User Equipment and a UTRAN access point. The system UE shall be capable of supporting a maximum number ofat least [6] radio links in the active set.

6.1.23.1.1.4 Active set update time intervaldelay

The active set update delay start is defined as the time from when the UE receives the active set update message from UTRAN, or at the time stated through the activation time when to perform the active set update. The activation time stop is defined as the time when the UE successfully only uses the set of radio links stated in that message for power control. The active set update delay is defined as the time between the active set update start and the active set stop.
The active set update delay for different number of added cells is stated in the table below. There is different requirement on the active set update delay depending on if the cell has been within the monitored set of cells for the last [FFS] [s] or not.An active set update of at least [FFS] seconds, after the reception of the UTRAN acknowledgement, shall be supported. The exact period will be determined by the used soft handover strategy/algorithm.

Number of new cells present in the active set update message	Maximum active set update delay [ms]	
	Cells within monitored set	Cells outside monitored set
1		
2		
3		

4		
5		
6		
…		

If an active set update includes a combination of cells included and not included in the monitored set the maximum active set update delay is the sum of respective maximum delays.

~~*6.1.3.1.1.5 Frame offset Measurement Accuracy*~~

~~For soft handover purposes, the frame offset between the serving BS and the new one has to be measured by the UE. This has to be measured with an accuracy of + [FFS] chips.~~

~~6.1.3.1.2RF Parameters~~

6.1.2~~3~~.2 FDD ~~Inter-Frequency~~Hard Handover

The hard handover procedure is initiated from UTRAN with an handover command message. The hard handover procedure may cause the UE to change its frequency.~~There will be the need to perform inter-frequency hard handover between two carriers in FDD mode. This is in particularly for the case for networks that support Hierarchical Cell Structures (HCS), i.e., combinations of macro, micro, pico and other specific application cells.~~

~~It is known that the service provided by a specific layer will not be continuous. This means that there are trans-layer handovers where the UE will be handed over to a macro layer, before returning again to the micro layer.~~

~~This necessitates good performance and also introduces the fact that during soft handoff within one layer, the UE shall be able to monitor other FDD carriers for the purpose of inter-frequency handover.~~

~~From the system perspective, the inter-frequency hard handover must have comparable performance to that of soft handover.~~

6.1.2~~3~~.2.1 Requirements

~~[The requirements presented in these sections will be reviewed depending on the further progress in TSG-RAN WG1 and TSG-RAN WG2]~~

6.1.2~~3~~.2.1.1 Maximum number of cells/frequencies to be monitored on other frequencies

~~For hard handover purposes, t~~The UE shall be capable of simultaneously measuring~~monitoring~~ the CPICH of at least [FFS] cells on a maximum of [FFS] frequencies, different from the frequency currently used by the UE.

The cells and frequencies are given to the UE in a measurement control message(s), and the measurement slots available with compressed mode is given through physical channel reconfiguration parameters ~~The exact number of frequencies to be monitored will be determined by the used hard handover strategy/algorithm~~.

6.1.2~~3~~.2.1.2 Measurement reporting delay

~~For hard handover purposes, the measurement reporting delay shall not exceed [FFS] seconds.~~

The measurement reporting delay start is defined as the time from when a report is triggered at the physical layer, and in the end of an available [FFS] ms measurement slot, according to the event or periodic mechanism set to trigger the measurement report. The measurement reporting delay end is defined as the time when the UE tries to transmit the measurement report over the Uu interface.

The measurement reporting delay is defined as the time between the measurement reporting delay start and the measurement reporting delay stop.

[Editors Note: The details for this requirement and the relation to compressed mode are FFS.]

For all possible events defined in the measurement control messages as inter-frequency measurement reporting criteria, the measurement reporting delay shall not exceed the time stated in the table below.

TTI for DCCH carrying measurement report [ms]	Maximum measurement reporting delay [ms]
10	
20	
40	
80	

~~6.1.3.2.1.3 Frame offset Measurement Accuracy~~

~~For hard handover purposes, the frame offset between the serving BS and the new one has to be measured by the UE. This has to be measured with an accuracy of +- [FFS] chips.~~
~~6.1.3.2.2 RF Parameters~~

6.1.2.2.1.3 Hard handover delay

The hard handover delay is defined as the time from when the UE receives the handover command message from UTRAN, until the UE successfully uses the entire set of radio links stated in that message for power control.
The hard handover delay is stated in the table below. There is different requirement on the hard handover delay depending on if the cell has been within the monitored set of cells for the last [FFS] [s] or not.

Number of new cells present in the handover command message	Maximum active set update delay [ms]	
	Cells within monitored set	Cells outside monitored set
1-6…		

18 Measurements Performance Requirements (FDD)

18.1.1 CFN-SFN Observed time difference

The CFN-SFN Observed time difference to cell indicates the time difference which is measured by UE between Connecting Frame Number in the UE and the System Frame Number of the target neighboring cell. The exact definition and further details on this parameter is contained in Chapter 9 of the TS25.302 "Services Provided by the Physical Layer".

For ~~Handover~~ intra- or inter-frequency neighbouring cells the precision required for this parameter is [ ] chip unit.

4 Proposal

It is proposed that chapter 6.1 and 18.1 of 25.103 [1] is updated according to the text in chapter 3.

5 References

[1] 3GPP TS 25.103 v2.0.0: “RF Parameters in Support of Radio Resource Management”