3GPP RAN WG1#2 **TSGR1#2(99)053**

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Title : First version of the 3GPP RAN WG1 specification S1.15 (FDD measurements)

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3GPP RAN S1.15 V0.0.1 1999-2

Measurements (FDD)

Contents

1 Intellectual Property Rights

<editor’s note : this section will be completed when an official format for the document is agreed>

2 Foreword

This Technical Specification (TS) has been produced by the 3G Partnership Project (3GPP) of the European Telecommunications Standards Institute (ETSI).

The contents of this TS are subject to change as the work continues

<Editor’s note : this version is the very first version produced in the merging phase between the ETSI and ARIB reference documents. The document does not incorporate yet any of the preferred choices from the ad-hocs, in particular ad-hoc on Handover. The document will be updated as decision is made by WG1 as a whole.

The text was edited with the following rules :

- *the text restricted to layer 1 issues. However in order not to loose material regarding other layers that was present in the XX.xy documents or ARIB vol 3 and not yet incorporated in the documentation of WG2 and WG3, , annexes were created to cover Handover execution aspects.*
- *When for a particular subjects, both ETSI and ARIB schemes were documented when different with explicit note.*
- *When only one proposal from either ETSI or ARIb was available for a particular subject then it was documented again with explicit indication, in an editor’s note.*
- *Text from ETSI and ARIB sometimes required some change either due to terminology or to consistency with other documents from WG1 or WG2. Modifications appear in the form of change bars.*
- *Editor’s notes were incorporated in order to seek progress on some particular areas and to provide a description of the scope of each section of the document*

>

3 Scope

This 3GPP Telecommunication Specification TS and the TS S1.25 contains the description of the measurements done at the UE and network in order to support operation in idle mode and connected mode.

As far as the measurements in idle mode are concerned, this TS described the following :

- measurements for the cell selection for a UE supporting FDD
- measurements for cell reselection for a UE camping on an FDD cell

As far as the measurements in connected mode are concerned, this TS describes measurements when the UE is connected to an FDD cell or cells (in Soft handover) for the cell connected state (see reference [8]), or camping on an FDD cell for the URA connected state. S1.25 provide an equivalent description for the TDD cells.

This TS provides the minimum requirements for the UE and networks. Some explanatory text is also contained in the TS but it is more of a descriptive nature than normative.

As far as the measurements for the handover preparation, this specification defines the requirements to the UE and network, as well as parametrisation rules for the slotted mode (or compressed mode) in order to accommodate idle periods. This latter aspects may need to be moved to some other specifications. The description of the slotted mode (different type of slotted frames define by the compressed mode A/B, the number if idle slots and the position of such idle slots) is outside the scope of this specification and is expected to be covered in S1.11 and S1.12.

<Editor’s note : Two specifications S1.15 and S1.25 are indicated in the WG1 documentation structure as FDD and TDD measurements respectively. Interpretation of title could lead potentially to three different interpretations

1) *the separation between S1.15 and S1.25 applies to the FDD mobile and the TDD mobiles respectively*
2) *the separation between S1.15 and S1.25 applies to the mode of the cell that the UE is connected to or camped on,*
3) *the separation between S1.15 and S1.25 applies to the cell that is to be monitored independently of the mode the UE is operated in.*

- *The choice made here correspond to the second listed alternative. Indeed we have to consider multi-mode UE that would need to monitor different type of cells in the same time, so case 1 is irrelevant, as well as case 3) is not appropriate since a multi-modeUE whatever mode it is operating in would need to monitor different type of cells.*
- *At some point S1.15 and S1.25 may need to be merged. Indeed separating leads to duplication of some text >*

4 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, subsequent revisions do apply.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] 3GPP RAN S1.11 Transport channels and physical channels (FDD)
[2] 3GPP RAN S1.12 Multiplexing and channel coding (FDD)
[3] 3GPP RAN S1.13 Spreading and modulation (FDD)
[4] 3GPP RAN S1.14 Physical layer procedures (FDD)
[5] 3GPP RAN S1.21 Transport channels and physical channels (TDD)
[6] 3GPP RAN S1.22 Multiplexing and channel coding (TDD)
[7] 3GPP RAN S1.23 Spreading and modulation (TDD)
[8] 3GPP RAN S1.24 Physical layer procedures (TDD)
[9] 3GPP RAN S2.02 Services provided by the Physical layer
[10] 3GPP RAN S2.03 UE functions and interlayer procedures in connected mode
[11] 3GPP RAN S2.04 UE procedures in idle mode
[12] XX.15, version 1.0.0 UTRA Handover
[13] XX.07, version 1.0.0 UTRA FDD, Physical layer procedures
[14] XX.13, version 1.0.0 UTRA TDD, Physical layer procedures
[15] ARIB, Vol 3

5 Measurements in idle mode

5.1 Measurements for cell selection

<Editor's note : In both ETSI and ARIB measurements for cell selection are not described apart from the initial cell search. Measurement to support Cell selection and cell reselection rely on synchronisation acquisition procedures currently described in section related to the Initial cell search procedures in [4] and Physical layer procedures (FDD) and Physical layer procedures (TDD) [8] for FDD cells and TDD cells respectively.

This section, measurements for cell selection, of this specification could contained the following sub-sections with scopes as provided in each section. This is not to be found in any of the reference documents and is only a suggestion for progress by the editor>

5.1.1 Cell selection monitoring frequency or cell set

<Editor's note : this section should define how the frequencies or cells to measure for the cell selection process are determined. This set should be provided by higher layers in the primitive that triggers the measurement process. Two following two cases might be considered and would lead to two different cell selection monitoring, defined in section 6.1.1, as in GSM. This is to be discussed with WG2.

- *Normal cell selection : the UE has no information at switch on. It would perform measurements on frequencies/cell that correspond to the mode it support and that was manually selected if applicable.*
- *Cell selection from stored list. The UE stored some information at switch off. At switch on cell selection is performed based on this stored information.*

>

5.1.2 Measurement from the cell selection monitoring set and reporting to higher layers

<Editor's note : requirements need to be defined based on collaborative work with other WGs>

5.2 Measurements for cell reselection

5.2.1 Cell reselection monitoring frequency or cell set

<Editor's note : this section should define how the frequencies or cells to measure for the cell reselection process are passed to the physical layer of the UE by higher layers and what information is passed in terms of cell mode, frequency, synchronisation information, in form of scrambling codes…. This set should be provided by the MAC layer in the

primitive that triggers the measurement process. This is referred to as the priority list in ETSI as far as the FDD and TDD cell/frequencies are concerned>.

<Editor’s note : the content of this section was extracted from reference [13] XX.07, UTRA FDD Physical layer procedures and modified so that is applies to both FDD and TDD when there is no principle difference. There is not equivalent section in reference [15], ARIB volume 3>

From a very general descriptive point of view, w~~W~~hen in idle mode, the UE continuously searches for new cells on the current and other carrier frequencies. The measurement for the cell reselection ~~cell search~~ are~~is~~ performed ~~done~~ in basically the same way as the cell selection~~initial cell search~~. The main difference compared to the cell selection~~initial cell search~~ is that a UE has received a priority list from the network, called the cell reselection monitoring set, which provides information relative to the cells to monitor.~~.~~
As far as FDD cells are concerned, p~~P~~rovision of the list ~~thus~~ significantly reduce the time and effort needed for the scrambling-code search (step 3) (see [4]). Also the complexity in the second step may be reduced if the priority list only includes scrambling codes belonging to a subset of the total set of code groups. The priority list is continuously updated to reflect the changing neighbourhood of the moving UE. (ETSI).
Content of the cell reselection monitoring set is further discussed in the following sections for FDD, TDD and GSM cells respectively.

5.2.1.1 Content of the cell reselection monitoring set for FDD cells

<Editor’s note : the text contained here comes from section 5.2 in [13] (UTRA FDD , Physical layer procedures>)

The content of the cell reselection monitoring set as far as FDD cells are concerned~~is~~ ~~priority list describes~~ provides the list of FDD cells/frequencies ~~in which order~~ ~~the~~ including the downlink scrambling codes and the order in which they should be searched for.~~ and~~

5.2.1.2 Content of the cell reselection monitoring set for TDD cells

<Editor’s note : the text contained here comes from section 6.6.2 in [14] (UTRA TDD , Physical layer procedures>)

~~When in idle mode, the UE continuously searches for new cells on the current and other carrier frequencies. The cell search is done in basically the same way as the initial cell search. The main difference compared to the initial cell search is that an idle UE has received a priority list from the network.~~ The~~is~~ cell reselection monitoring set priority list describes in which order to search for TDD~~other~~ cells.

5.2.1.3 Content of the cell reselection monitoring set for GSM cells

To be added

5.2.2 Measurements for cell reselection and reporting to higher layers

<Editor’s note : requirements need to be defined based on collaborative work with other WGs>

6 Measurements in connected mode

6.1 Measurements for the handover preparation

6.1.1 Cell sets for the handover preparation

<editor’s note : A cell set corresponds a list of cells that the UE needs to monitors for a given period of time, with associated requirements, as seen from the physical layer. Several sets are defined since different requirements might be defined, e.g. some cells might need to be monitored more often than others…It is not clear at this stage how such sets will be provided by the MAC layer. The primitives that allow the MAC layer to control the measurement process in the layer 1 are under definition by the RAN WG2. Several cases might be considered :

- *the MAC has a very fine control of the measurement, upto the frame level, decides on the measurement of particular cells at particular instant and the physical layer report measurement back to the MAC layer e.g. after a slotted frame, some processing being possibly needed by the MAC*
- *The MAC provides sets of cells to monitor and monitoring periods in the form of e.g. slotted frame or DTX period and it is up to the physical layer to organise the monitoring*
- *In the following we consider the second case, because it is more in line with the available documentation from . It the first case of some intermediate case was to be considered in the future then some material of the section would need to be move to the relevant RAN WG2 documentation.*
- *The text provided here is extracted from reference [12], XX15, UTRA Handover. There is no equivalent section in reference [13].>*

6.1.1.1 Overview of the different sets

The physical layer of the UE should be provided~~maintain~~ by higher layers the following lists of cells :

- *Handover Monitoring set* : All cells (UTRA or from other systems like GSM) that the UE has been tasked by the UTRAN to monitor when in active mode.
- *Active Set*: The UTRA cells currently assigning a downlink DPCH to the mobile station, which corresponds to the cell between which the UE in a soft handover~~or softer handover~~ with. The active set may only correspond to UTRA cells.
- *Handover candidate Set*: The cells that are not currently in the Active Set but have been received by the UE with sufficient strength to indicate that the associated DPCHs could be successfully demodulated. These correspond to the cells that are effectively reported by the UE to the UTRAN. These cells may be on the same or different frequencies from the current frequency assignment. Cells in the handover candidate set may be UTRA or GSM cells.

~~tbc~~

<Editor’s note : these different sets were defined in XX.15 for the definition of requirements for the measurements for handover preparation as well as for the reporting or handover triggering. Since the approach now is to reduced the scope of this specification to the measurement only, there might not be a need to make define the same sets. Only set that would lead to different requirements or process for the measurement need to be defined. Here it is anticipated that cells in the active set, which are the serving cell are measure for each frame, whereas cell which are not part of the active set are not measured as often as every frame. Cells which have been identified by the MAC as candidate cell may need tobe measured more often than other cell, since they are maong the x strongest. >

6.1.1.2 Content of the sets

6.1.1.2.1 handover monitoring set

The handover monitoring set contains the cells to be monitored by the UE in active mode. It is provided to the physical layer by higher layers, as part of the primitives (see [8]). ~~It may be provided by the UTRAN via the BCCH of the serving cell(s) or via UE specific signalling on the DCH.~~

The handover monitoring set may contain cells on the same frequency and/or cells on different frequencies. The following sections indicate which information are included in the handover monitoring set for cell on the same frequency and cells on different frequencies.

6.1.1.2.1.1 FDD cells on the same frequency

For each cell to monitor at the same frequency, the handover monitoring list contains at least the following information:

- The cell scrambling code used for downlink scrambling.
- The cell ID number

It is assumed that the mapping of the cell scrambling codes in relation to the synchronisation channel codes (groups indicated by the secondary synchronisation channel) is known beforehand with the code grouping being determined beforehand.

<editor’s note : this may be better described in the WG2 documentation. Some text may be however useful here for explantory purposes>

6.1.1.2.1.2 FDD cells on different frequencies

<editor’s note : no text in XX.15>

6.1.1.2.1.3 TDD cells

<editor’s note : no text in XX.15>

6.1.1.2.1.4 GSM cells

<editor’s note : no text in XX.15>

6.1.1.2.2 active set

<editor’s note : no text in XX.15>

6.1.1.2.3 candidate set

<editor’s note : no text in XX.15>

6.1.2 Measurement triggering criteria

<Editor’s note : >

6.1.3 Measurements for the handover preparation from UTRA FDD to UTRA FDD at the UE

6.1.3.1 In general

6.1.3.2 monitoring of FDD cells on the same frequency

<Editor's note : no requirement has been defined yet, in terms e.g. of number of cells to be able to monitor in a given time, precision of individual measurements... Text included in this section is more of a descriptive nature and provide the list of measurements to be reported by the physical layer to higher layer. Details on the measurements should be available in section 7>

During the measurement process of cells on the same frequencies, the UE shall find the necessary synchronisation to the cells to measure using the primary and secondary synchronisation channels and also the knowledge of the possible scrambling codes in use by the neighbouring cells.
As the UE does measurement, at least the following information is obtained:

- Relative signal strength of the measured cell
- Relative timing between the cells, measured for example from the phase difference between the scrambling code, depending on the timing difference between the cells.

6.1.3.3 monitoring of FDD cells on different frequencies

To support monitoring of ~~inter frequency~~ cells on other frequencies~~measurements~~, the downlink~~forward link~~ transmission may, on network command, enter in slotted mode, where the different set of slotted frames is described in reference [2], S1.12.~~Compressed Mode. In Compressed Mode, slots N_{first} to N_{last} are not used for transmission of data, and BTS stops transmission to make idle mode. The MIL pattern for Compressed Mode is obtained by the method described in 3.2.3.3.1.~~ What frames to be compressed are decided by the network.

6.1.3.3.1 Parametrisation of the slotted mode (set of idle time periods)

<editor's note : separating the parametrisation of the slotted mode for each case (FDD cell, TDD cell, GSM cells) assumes that an idle period is used only for one type of cell. Though the slotted mode has to be co-ordinated. This section could provide some first indication on how to parametrise the slotted mode knowing that section 7.1.6 must provide a global view, both in terms of slotted mode parametrisation but also requirements>

<Editor's note : there is no text in the equivalent section of reference [12]XX.15, UTRA Handover The text included here corresponds to the text contained in section 3.2.6.6.3.5 of reference [15], ARIB volume 3. Consistency of the approach with handover preparation from FDD to GSM should be further investigated. The text as it is may be understood as the fact that for e.g. TA1 msec all frames are slotted; which is different from section 6.5.1.2, that would correspond to a Periodic pattern >

To support allow monitoring of FDD cell on other frequencies~~W-CDMA inter-system handover~~, the following set of idle time periods shall be used:

- T_{A1} msec [in fixed idle position] [with double-frame method] for power measurement
- T_{A2} msec [in fixed idle position] [with double-frame method] for slot/symbol synchronization
- T_{A3} msec [in fixed idle position] [with double-frame method] for frame synchronization and code-group identification
- T_{A4} msec [in fixed idle position] [with double-frame method] for scrambling-code identification
- T_{A5} msec [in fixed idle position] [with double-frame method] for the reception of control information

6.1.3.3.2 Measurement requirements

<Editor's note : there is no requirement specified in either of the reference documents (XX.15 or Vol 3 of ARIB). The reported value itself is not specified but is expected to correspond to a useful received power level, and potentially some relative timing information. The requirements could also be expressed minimum of samples for the monitoring time assigned by higher layers, precision of the relative received power, taking into account to structure of the monitoring set….>

6.1.4 Measurements for the handover preparation from UTRA FDD to UTRA TDD at the UE

<Editor's note : there is no text in the equivalent section of reference [12]XX.15, UTRA Handover, neither in reference [15], ARIB volume 3>

6.1.4.1.1 Parametrisation of the slotted mode (set of idle time periods)

<Editor's note : it is not clear whether the corresponding section for the FDD cells should be copied here >

Use of the uplink slotted mode together with the downlink slotted mode is needed for the monitoring of TDD cells (ETSI).

6.1.4.1.2 Measurement requirements

<editor's note : Same editor's note as for section 6.1.3>

6.1.5 Measurements for the handover preparation from UTRA FDD to GSM at the UE

<editor's note : The content of this section has been extracted from reference [12], XX.15, UTRA Handover>

6.1.5.1 Introduction

The handover between UTRA and GSM system offering world-wide coverage already today has been one of the main design criteria taken into account in the UTRA frame timing definition. The GSM compatible multi-frame structure, with the super-frame being multiple of 120 ms, allows similar timing for inter-system measurements as in the GSM system itself. The compatibility in timing is important, that when operating in UTRA mode, a multi-mode UE is able to catch the desired information from the synchronisation bursts in the synchronisation frame on a GSM carrier with the aid of the frequency correction burst. This way the relative timing between a GSM and UTRA carriers is maintained similar to the timing between two asynchronous GSM carriers.

UTRA/FDD-GSM dual mode UEs can be implemented without simultaneous use of two receiver chains. Although the frame length is different from GSM frame length, the GSM traffic channel and UTRA FDD channels use similar 120 ms multi-frame structure. Similar timing can be naturally done with UTRA TDD mode as well.

A UE can do the measurements by using idle periods in the downlink transmission, where such idle periods are created by using the downlink slotted mode as defined in reference [2]. In addition to downlink slotted frames for measurements, the UTRAN will provide uplink slotted frames to allow the UE to GSM cells on frequencies closed to the FDD uplink band. The slotted mode is under the control of the UTRAN, and the UTRAN should communicate to the UE which frame is slotted. .

Alternatively independent measurements not relying on the slotted mode, but using a dual receiver approach can be performed, where the GSM receiver branch can operate independently of the UTRA FDD receiver branch.

For smooth inter-operation between the systems, information needs to be exchanged between the systems, in order to allow the UTRAN to notify the UE~~terminal~~ of the existing GSM frequencies in the area (see section 6.1.1.2.1.4). Further more integrated operation is needed for the actual handover where the current service is maintained, taking naturally into account the lower data rate capabilities in GSM when compared to UTRA maximum data rates reaching all the way to 2 Mbits/s.

The current section addresses in a first part the parametrisation of the slotted mode- and in second stage the monitoring process in a more global way and encompasses the setting of monitoring set and reporting. The section is organised as follows :

In section 6.5.1.2~~9.2.1.1~~ silence durations definition and parametrisation for SCH or FCCH tracking for one GSM either at initial search or for reconfirmation are defined. Such silence durations SDc correspond to the time required for a UE to listen to c consecutive GSM time-slots and are therefore contained in the idle period generated by the use of slotted frames. There is hence a correspondence between allocation by the UTRAN of slotted frames and silence durations. The subsequent sections 6.5.1.2.1~~9.2.1.1~~.2, 6.5.1.2.2~~9.2.1.1~~.3 and 6.5.1.2.~~9.2.1.1.~~4 then discuss the appropriate Silence duration pattern depending on the availability of timing information between UTRA serving cells and the GSM cell and whether the silence duration is used to initial tracking of a new GSM cell or reconfirmation. Addition silence duration will be required for power measurement of one or multiple GSM cells.

- Section 9.2.1.2 addresses the parametrisation of the silence durations or equivalently the slotted mode when considering the monitoring of all cells, which requires a combination of power measurements and synchronisation tracking of one cell as a minimum. Different handover scenarios in terms of inter-operability as defined in XX.16 are addressed.
- Finally section 9.2.1.3 addresses the monitoring in a more general view.

6.1.5.2 Definition and setting of silence duration parameters

6.1.5.2.1 Definition of silence duration parameters

This section provides a set of definitions for the parametrisation of the slotted mode **,** together with minimum requirement in terms of measurement by a UE

SD_c is defined as the following :

$$SD_c = 2 * t_{synth.} + (c+1) * TS_{GSM}$$

where,

$t_{synth.}$: $t_{synth.}$ is the maximum allowed delay for a UE's synthetizer to switch from one FDD to one GSM frequency. Typically this value could be derived, from the larger frequency difference switch (= 1245 MHz) which is the one from upper FDD downlink frequency (2170 MHz) to lower GSM downlink frequency (925 MHz) . The value of $t_{synth.}$ is set to [500 µs].

c : integer value {0,1,2,3,4,5,6,7,8}

TS_{GSM} : GSM timeslot duration. 577 µs

SD_c : silence duration number c. SD_C is the necessary time for a dual mode UE to switch to one GSM frequency, *decode* c consecutive GSM slots and switch back to the current FDD carrier. In the particular case where the scheduling of silence duration SD_c is synchronised with the scheduling of GSM timeslots, the UE can decode (c+1) consecutive GSM time slots.

<editor's note : SDc with this definition and the 500 us switching time corresponds to a different idle times when looking at the definition of the slotted mode provided in [15], ARIB vol 3 table 3.2.6-1 and to be described in [2], S1.12. Each SDc leads to a number of idle slots in a frame. The correspondence between the two is still missing. The requirement for the UE should be that within SDc second the UE decodes a minimum of C GSM time-slot. The 500 us is not a requirement in itself>

SD pattern : a set of consecutive silence durations enabling the capture of at least one timeslot 0 of one GSM BCCH carrier.

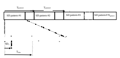
<Editor's note : this SD pattern is the equivalent of idle time periods in section 6.1.3.3.1>

T_{SDc} : delay between two consecutive silence durations within a SD pattern when GSM timeslot number i mod(8) is the first timeslot to be captured by the first silence duration and GSM timeslot number (i+c) mod(8) is the first timeslot to be captured by the second silence duration.

$T_{pattern}$: delay between two consecutive patterns, optionally generalised to $T_{pattern1}$ and $T_{pattern2}$ to be used alternating between consecutive patterns.

$N_{pattern}$: number of consecutive patterns to be used for scanning a particular GSM frequency before this search attempt is assumed to be unsuccessful.

<Editor's note : constraints on Tpattern values taking into account the parameters of the slotted mode (number of idle slots, type of slotted frame….,) should be added, unless the SDc and $SD_{pattern}$ are turned into exact slotted mode description >



$T_{pattern1}$ $T_{pattern2}$

Figure 1 : illustrations of SD patterns, silence duration SD_c ,$T_{pattern1}$,$T_{pattern2}$, T_{SDc} and $N_{pattern}$.

6.1.5.2.2 Setting of SD parameters for first SCH decoding without any timing knowledge

The setting of the SD patterns is described in this section when used for first SCH decoding of one cell when there is no knowledge about the relative timing between the current FDD cells and the neighbouring GSM cell. The UE needs to perform a new SCH search procedure whenever a new neighbour cell is received with a sufficiently high power level (see 9.2.1.1.4).

Silence durations for FDD mode can be used in the downlink in order to enable a one receiver dual mode UE to acquire synchronisation from neighbouring GSM cells. Depending on the UE’s capabilities, the search procedure may be sequential (tracking of FCCH burst before decoding of the first SCH) or parallel (parallel tracking of FCCH and SCH bursts). The latter solution achieves SCH decoding faster than the first one thus decreasing the needed number of SD patterns. For example a parallel search with 2 SD patterns every 480 ms using alternatively $T_{pattern1}$ = 216,92 ms (= 47*4,615 ms) and $T_{pattern2}$ = 263,08 ms (= 57*4,615 ms) will be as efficient as a sequential search with 4 SD patterns per 480 ms with $T_{pattern}$ = 120 ms. This has been verified by checking which GSM frame numbers will be observed during 6 successive silence durations for each of the 51 possible frame numbers where the search can happen to be started (note that the GSM FCCH/SCCH schedule has a periodicity of 51 frames).

The parameter $N_{pattern}$ allows to trade in the detection probability on a particular GSM cell against the number of slotted frames i.e. against the impact on the running UTRA connection. By default $N_{pattern}$ should be set to 11 for the serial and 6 for the parallel search procedure. This makes sure a detection is possible even for the worst case relative timing of the GSM cell.

If silence durations are allocated by the UTRAN on a periodic basis in the downlink, then it is up to the UE to trigger the search procedure with the available silence durations. In this case, no specific signalling is needed between the UE and the UTRAN.

If silence durations are not allocated on a periodic basis, the UE then initiates the search procedure by sending a "request new cell search" message to the UTRAN also signalling its capabilities for serial or parallel search as described above. The UTRAN then determines a suitable silence period pattern and signals this to the UE using the normal silence duration indicators. The UTRAN can delay the onset of this pattern depending on the timing priority the Network Operator has set for new BSIC identification.

Once the UE has completed the search it signals the UTRAN with the timing of the associated SCH burst or with SCH-not-found (see 9.2.1.1.3) and the UTRAN ceases the silence duration pattern.

Here are some exaemples of silence durations and associated SD patterns (at least one GSM timeslot 0 is capture within each SD pattern) :

Silence Duration	Number of Silence Durations per SD pattern	T_{SDc} between 1st and 2nd SD (in TS_{FDD})	T_{SDc} between 2nd and 3rd SD (in TS_{FDD})	T_{SDc} between 3rd and 4th SD (in TS_{FDD})
SD_2 (= 5 * TS_{FDD})	4	24	24	24
SD_3 (= 6 * TS_{FDD})	3	84	84	N.A.
SD_4 (= 7 * TS_{FDD})	2	48	N.A.	N.A.
SD_3 and SD_5	2	84	N.A.	N.A.
SD_5 and SD_5	2	108	N.A.	N.A.
SD_6 (=9 * TS_{FDD}) and SD_2	2	72	N.A.	N.A.
SD_8 (=10 * TS_{FDD})	1	N.A.	N.A.	N.A.

Table 1 . some possible SD_c combinations for SD pattern.

6.1.5.2.3 Setting of SD parameters for first SCH decoding with timing knowledge and procedure at the UE

The setting of the SD pattern is described in this section for the case where some knowledge on the relative timing between the UTRA FDD cells in the active set and the neighbouring GSM cells is available at the UE, either because delivered by the UTRAN or due to prior knowledge consecutive to previous FCCH detection by the UE

For GSM cells when the timing is known, the slotted frames (silence durations) can be allocated for a specific frame intended to capture a specific SCH (or FCCH if needed) from the GSM cell with known frame timing with relative to UTRA FDD cells in the active set.

The control is implemented over 306 frames, equal to 13 GSM « 51 multi-frame » duration. As the UTRA 720 ms superframe shifts ¼ of superframe during the period, the 4 times 306 period can be used to fully align the timings of a UTRA FDD and a GSM cells.

The UE needs to perform a new SCH search procedure whenever a new neighbour cell is received with a sufficiently high power level (see 9.2.1.1.4). The UE then initiates the search procedure by sending a "request new cell search" message to the UTRAN.

Signalling from the UTRAN to the UE for the use of one slotted frame for SCH decoding

<Editor's note : the text in this section is written as the peer to peer communication but it should be rewritten from the Layer 1 point of view as the content of the primitive between the physical lauer and higher layers. It shoul dbe moved to S2.02 at some point.>

Then the UTRAN sends to the UE specific signalling with the following information :.

- The frame number where slotted mode occurs (frame number x+n times 306, where n=0,1,2,3)
- The GSM carrier for which the particular slotted frame is intended (BS ID, carrier no, etc.)
- The type of slotted mode that will occur (end, middle frame, etc.)

The signalling has to be UE specific as :

- All UEs should not make measurements at the time instant
- All UEs may not be dual mode

Reporting to higher layers (or to the UTRAN)

Once the UE has completed the search it signals the UTRAN with the timing of the associated SCH burst or with SCH-not-found (see 9.2.1.1.3) and the UTRAN ceases the silence duration pattern.

6.1.5.2.4 Setting of SD parameters for SCH decoding for BSIC reconfirmation and procedure at the UE

In this paragraph it is assumed that the UE has successfully decoded one SCH burst of a given neighbouring GSM cell during the call.

If silence durations i.e. slotted frames are allocated on a periodic basis in the downlink, then it is up to the UE to trigger and perform the BSIC reconfirmation procedure with the available silence durations. In this case, no specific signalling is needed between the UE and the UTRAN for BSIC reconfirmation procedure.

If silence durations are not allocated on a periodic basis in the downlink, the UE indicates to the UTRAN the schedule of the received neighbour cell SCH bursts and the size of the necessary silence duration in order to capture one SCH burst. The Network Operator decides the target time for BSIC reconfirmation and the UTRAN uses this and the schedule indicated by the UE to determine an appropriate silence duration pattern. This is signalled to the UE using the normal silence duration indicators. Also if the FDD network as a priori timing knowledge of neighbouring GSM cells as in 6.1.5.2.3.9.2.1.1.2 then it can schedule silence durations for BSIC reconfirmation. In that case the signalling is similar to the one in paragraph 6.1.5.2.3.9.2.1.1.2.

6.1.5.2.5 Setting of SD parameters for Power measurements

For power measurements of GSM carriers , additional silence durations will be used for single receiver FDD/GSM UE. Requirements concerning the number of power measurements per slotted frames are for further study.

6.1.5.3 Parametrisation of the silence durations for handover preparation to GSM

Whereas section 6.1.5.2 9.2.1.2 described the silence duration parametrisation for the initial synchronisation tracking or reconfirmation for one cell and the silence duration parameter for power measurement for one of multiple cells, there is a need to define the global silence duration parameters when considering the monitoring of all GSM cells.

<Editor's note : the overall description for the handover to GSM preparation is still missing. Some text was available in XX.15 but was either outside the scope of this document or inconsistent with previous sectiosn. Moreover it dod not address the point for the global measurement process and associated minimum requirement. Some work is therefore needed on this. >

6.1.6 Mesurements for the Handover preparation in FDD at the UTRAN side

<editor's note : this is not described in either of the documents. However the handover triggering might not be due only to conditions on the downlink. Measurements performed by the cells in the active set might be needed as in GSM. This section has been created for that purpose >

6.1.7 Overall handover preparation

This section should explain how the inter-frequency handover preparation from UTRA FDD to UTRA (either FDD or TDD) and from UTRA to GSM are co-ordinated in terms of measurement and reporting. Whereas Section 6.1.39.1.1, 6.1.49.1.2 and 6.1.59.2.1.2 give some principle for the monitoring of a given cell type and requirement in e.g. the dimensioning of the slotted mode, this section provides the overall requirement and measurement procedure.
<Editor's note : no text is available is either of the reference documents, XX.15 or ARIB volume 3>

6.1.8 Measurement reporting to the higher layers

6.1.8.1 Reporting scheme

The UE sends regular (or event driven) measurement reports to the UTRAN. The level of filtering done by the physical layer vs. the filtering done by higher layers needs to be further discussed.

6.1.8.2 Measurement report content for cells on the same frequency

These measurements include (for cells on the same frequency)

- The Cell ID
- The relative signal strength
- The relative timing information, accuracy TBD.

Measurement report content for FDD cells on different frequencies

6.1.8.3 Measurement report content for TDD cells

6.1.8.4 Measurement report content for GSM cells

6.2 Measurements for the cell reselection in active mode

<Editor's note : Depending on state the UE is in while in connected mode, the cell change operation can be performed using various procedures, such handover or cell reselection. Cell reselection might be appropriate for packet transmission. As an example this is what is done in GSM GPRS. The text included in this section is copied from reference [13], but is of a descriptive nature. Requirements will need to be defined as soon as the procedure is clarified by WG2>

When in active mode, the UE continuously searches for new base stations on the current carrier frequency. This cell search is carried out in basically the same way as the idle mode cell search.

6.3 measurements for power control ?

<Editor's note : there is presently no measurement defined for the support of power control that is reported over the radio. There might be however layer some measurements exchanged between the different UTRAN entities and that will need to be standardised in relation with power control. This is to be clarified with WG2 and WG3>

6.4 Measurements for adjacent protection rule

<Editor's note : some additional measurement might be needed in order to provide the network with information on adjacent channel interference. The text in this section is copied from reference [15], section 3.2.6.11.5). There is no equivalent text in ETSI documents>

6.4.1.1 Frequencies to measure

On the BCCH, UTRANBTS transmits frequency information of candidate frequencies and neighbouring frequencies. A candidate frequency is defined as a frequency that can be used by the own network, and a neighbouring frequency is defined as a frequency that is adjacent to a candidate frequency and cannot be used by the own network. Candidate frequencies are classified into adjacent frequencies and non-adjacent frequencies. An adjacent frequency is defined as a candidate frequency that is adjacent to a neighbouring frequency, and a non-adjacent frequency is defined as a candidate frequency that is not adjacent to a neighbouring frequency. A pair of dlforward-link and upreverse-link non-adjacent frequencies may be allocated to all UEMS.

6.4.1.2 Measurement to perform

To support adjacent channel protection rule, an MS measures Q_1 and Q_2 , where Q_1 is the received power in dBm of the downforward link adjacent frequency, and Q_2 is the received power in dBm of the downforward link neighbouring frequency that is adjacent to the downlinkforward link adjacent frequency.

6.4.1.3 Frequency allocation rule

A pair of forward-link and reverse-link adjacent frequencies may be allocated to the MS if Q_2 - Q_1 is less than R_{ACP} dB. During communication using a pair of downforward link and upreverse-link adjacent frequencies, the MS measures Q_1 and Q_2 by the same means with the power measurement for inter-frequency handover described in 3.2.6.6.3. *This measurement is conducted at least once in T_{INT} second, and the MS starts inter-frequency handover to a pair of downforward link and upreverse-link non-adjacent frequencies if Q_2 - Q_1 is larger than R_{ACP} dB.*
<Editor's note : the rule in itself is outside the scope of this document. Only the measurement aspects should remain>

(Note: If the separation of some pairs of a forward-link frequency and a reverse-link frequency is not a pre-determined constant in some networks, the following adjacent channel protection rule shall be applied. The italic part may be moved to a higher layer.)

6.5 Measurements for radio-link time-out (or sync loss) ?

7 Radio link measurements

<editor's note : this section should described the measurements that are performed either at the UE or UTRAN side and that are

- *either reported and can be checked on the interfaces*
- *or lead to some procedures in the mobile, leading to an expected behaviour of the said UE.*

This section can provide some requirements on the measurement in terms of precision for various conditions, although some of this might be more applicable to the WG4 documentation. The mapping of the raw values onto reported values with a limited range, where such reported values transit between layers or across the interface should be also given. Only the acronyms are provide here>

RSSI : Received signal strength for useful part
ISSI : Interference signal strength
SIR : Signal to interference ratio
Relative signal strength (for Handover)

Relative timing difference between cells = for FDD this corresponds to the phase difference between the scrambling codes

8 Annex 1 : Handover scenarios (Informative)

<Editor's note : This whole section is based on section 7 in XX15 version 1.0.0 from ETSI>

8.1 Introduction

This section studies the handover scenarios from the deployment point of view. It should in particular provide the rules for setting the handover monitoring set (see section), in particular the number of GSM, FDD and TDD cells to monitor. Based on deployment scenarios and UE's speed, it should also set the requirement in terms of detection time and reporting time of a strong cell.
As far as the handover between UTRA and GSM, the handover scenario will be based on interoperability aspects described in XX.16, which among other things will indicate when a handover is needed between UTRA and GSM from the service availability point of view.

8.2 UTRA-UTRA handover scenarios

8.3 UTRA-GSM handover scenarios

9 Annex 2 : Handover execution (Should be moved to S2.04 at some stage)

9.1 Soft handover

<Editor's note : the handver complete procedure is outrside the scope of this specfciation. However it order not to loose information and before the documentation of WG2 covers this, the content of the reference document is put here. Detailed study of the differences is still to be made>

<Editor's note : text from XX.15>

The serving cell (s) (the cells in the active set) are expected to have knowledge of the service used by the UE. The new cell decided to be added to the active set shall be informed that a new connection is desired, and it needs to have the following minimum information forwarded to it via UTRAN.

- Maximum data rate of the connection and other service parameters, such as coding schemes, number of parallel code channels etc. parameters which form the set of parameters describing the different transport channel configurations in use both uplink and downlink.
- The UE ID and uplink scrambling code
- The relative timing information of the new cell, in respect to the timing UE is experiencing from the existing connections (as measured by the UE at its location). Based on this the new cellcan determine what should be the timing of the transmission initiated in respect to the timing of the common channels (BCCH) of the new cell.

As a response the UE needs to know via the existing connections:

- From which frame (assuming active set update accepted) does the new cell initiate the transmission to the UE
- What channelisation code(s) are used for that transmission. The channelisation codes from different cells are not required to be the same as they are under different scrambling code anyway.
- The relative timing information, which needs to be made available at the new cell is indicated in Figure 1 (shows the case where the two involved cells are managed by different Node Bs).

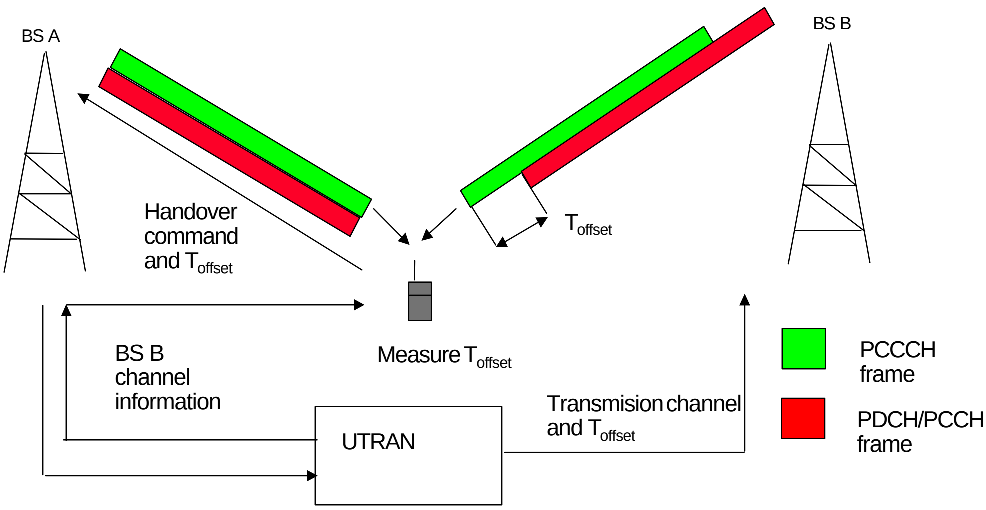


Figure 2. Making transmissions capable to be combined in the Rake receiver from timing point of view.

At the start of diversity handover, the reverse link dedicated physical channel transmitted by the MS, and the forward link dedicated physical channel transmitted by the diversity handover source BTS will have their radio frame number and scrambling code phase counted up continuously as usual, and they will not change at all.

Naturally, the continuity of the user information mounted on them will also be guaranteed, and will not cause any interruption.

<Editor's note : text from ARIB, volume 3>

The synchronization timing upon starting diversity handover are presented in Fig. 3.2.5-4. The synchronisation establishment flow upon intra/inter-cell diversity handover is described in Fig. 3.2.6-4.

(a) The MS measures the frame time difference of the radio frame at the same frame number between the reverse link dedicated physical channel and the perch channel transmitted at the handover destination BTS. These measurements shall be notified to the network. The measured value is the time difference of the frame timing of the reverse link dedicated physical channel against the frame timing of the perch channel. The values shall always be positive values in chip units, and the range shall be 0 ~"reverse link scrambling code cycle-1" chip.

(b) The MS notifies the frame time difference measurement values as layer 3 signals to the BSC via the diversity handover source BTS with the DCH of the reverse link dedicated physical channel.

(c) The BSC notifies the frame time difference measurement result, together with the frame offset and slot offset set up upon originating/ terminating call connection, to the diversity handover destination BTS with layer 3 signals. Furthermore, the BSC notifies radio parameters such as the spreading codes used at the handover destination BTS etc., to the MS via the handover source BTS.

(d) The MS starts the chip synchronisation establishment process of forward link channel from the handover destination BTS with the notified radio parameters. The reverse link channels being transmitted shall continue transmission without any operations performed.

(e) The handover destination BTS receives the notification of the above frame time difference frame offset, and slot offset. Utilising these informations, the BTS starts the transmission of forward link dedicated physical channels and starts the synchronization establishment process of reverse link dedicated physical channel transmitted by the MS. See chapter 3.2.5.1 for the specific transmission timing of forward link dedicated physical channels, and the reception timing of reverse link dedicated physical channel. As soon as chip synchronisation and frame synchronisation using Frame Synchronization Word are established, hard wired transmission shall be started.

(f) Based on the handover destination perch channel reception timing, the MS establishes chip synchronisation of forward link channel from handover destination BTS. As soon as chip synchronisation is established, maximal ratio combining with the forward link channel from handover source BTS shall be started.

(See also Appendix D)

Fig. 3.2.6-4 Synchronisation Establishment Flow Upon Intra/Inter-cell Diversity Handover

10 History

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V.0.0.3		
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