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Technical Specification

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Contents

1 Intellectual Property Rights

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2 Foreword

This Technical Specification has been produced by the 3GPP.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

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3 Indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the specification;

3 Scope

This 3GPP Telecommunication Specification TS contains the description of the measurements for TDD 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 and/or TDD
- measurements for cell reselection for a UE camping on an FDD or TDD cell

As far as the measurements in connected mode are concerned, this TS describes measurements when the UE is connected to a TDD cell for the cell connected state (see reference [8]). 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 UTRAN.

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 25.211 Transport channels and physical channels (FDD)

[2] 3GPP RAN 25.212 Multiplexing and channel coding (FDD)

[3] 3GPP RAN 25.213 Spreading and modulation (FDD)

[4] 3GPP RAN 25.214 Physical layer procedures (FDD)

[5] 3GPP RAN 25.221 Transport channels and physical channels (TDD)

[6] 3GPP RAN 25.222 Multiplexing and channel coding (TDD)

[7] 3GPP RAN 25.223 Spreading and modulation (TDD)

[8] 3GPP RAN 25.224 Physical layer procedures (TDD)

[9] 3GPP RAN 25.302 Services provided by the Physical layer

[10] 3GPP RAN 25.303 UE functions and interlayer procedures in connected mode

[11] 3GPP RAN 25.304 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

[16] 3GPP RAN 25.215 Physical layer measurements (FDD)

5 Control of UE/UTRAN measurements

<Editor's note: In this chapter the general measurement control concept defined in WG2 shall briefly be described to get an understanding on how L1 measurements are initiated and controlled by higher layers. It shall be described how measurements are controlled both in idle and connected mode. In WG2 a measurement control concept is defined, where higher layers control what to measure, how often to measure, when to report (criteria), filtering of measured value.>

5.1 Measurement reporting to the higher layers

<Editor's note : This section should be updated in order not to make any assumption on the reporting scheme between the UE and the UTRAN but deal with only reporting to higher layers>

5.1.1 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.

5.1.1.1 Measurement report content for DCA

- Pathloss of a sub-set of cells ([7]bit quantisation; max. number of cells is [30])
- Inter-cell interference measurements of all DL time slots requested by the UTRAN ([5] bit quantisation)
- BER of serving link before channel decoding ([4] bit quantisation)
- Transmission power of the UE on serving link ([6] bits quantisation)
- DTX flag indicating, whether measurements have been performed during DTX periods

6 Measurement abilities for UTRA TDD

<Editors note: In this chapter definitions for physical layer measurements reported to higher layers, as required by RAN WG2, shall be made. Maybe also UE internal measurements (not reported over the air-interface shall be defined.>

<Editor's note: Cell selection and reselection should be distinguished if they use different measurements.>

<Editors note: Filtering/averaging is not included in the L1 specification at the moment. However, it would be beneficial to continue the discussion on this issue via email >

The purpose fields in the subsections serve as information. <Editor's note: This is especially useful to align the specified measurements in RAN WG1 with the algorithms/procedures specified in RAN WG2. It is not excluded to use a measured quantity for a different purpose as far as this has no influence on other specifications.>

Due to the TDMA component of TDD most of the measurements have to be done on a timeslot basis.

<Editor's note: RAN WG1 should work on the performance analysis for measurements and report to RAN WG2 about monitoring frequency needed for certain performance.>

6.1 UE measurement abilities

The following table provides an overview of the UE measurement abilities:

Note: The term "Measurement target" refers to either physical channel(s), carrier, transport channel, channelisation code, etc.

No.	**Measurement ability**	**Measurement target where the measurement shall be possible (Idle mode= I / Connected mode = C)**	
		Intra-frequency	Inter-frequency
1	RSCP	PCCPCH (I/C) of own and neighbour cell, DPCH (C), PDSCH (C)	CPICH (I/C) for FDD cells, PCCPCH (I/C) for TDD cells
2	ISCP	DPCH (C), PDSCH (C), PCCPCH (C) of own cell	n.a.
3	RSSI	DL carrier (I/C)	DL carrier (I/C) for UTRA cells, BCCH carrier (I/C) for GSM cells

No.	Measurement ability	Measurement target where the measurement shall be possible (Idle mode= I / Connected mode = C)	
		Intra-frequency	Inter-frequency
4	SIR (=RSCP/ISCP)	DPCH (C), PDSCH (C), PCCPCH (C) of own cell	n.a.
5	Ec/No (=RSCP/RSSI)	PCCPCH (I/C) of own and neighbour cell, DPCH (C), PDSCH (C)	CPICH (I/C) for FDD cells, PCCPCH (I/C) for TDD cells
6	Physical Channel BER	DPCH (C), PDSCH (C)	n.a.
7	Transport Channel BLER	DCH (C), DSCH (C)	n.a.
8	UE TX Power	In a timeslot (C)	n.a.
9	Observed time difference between serving TDD cell and target cell	Time difference in the frame timing considering PCCPCH (C)	Time difference in the frame timing considering CPICH (I/C) for FDD cell, PCCPCH for TDD cell and BCCH (I/C) for GSM cell

Note 1: Measurements for TDD which are carried out on Primary CCPCH (PCCPCH) can also be carried out on a Secondary CCPCH if it has the same constant power level as the PCCPCH and no beamforming is used for the SCCPCH.

Note 2: SIR and Ec/No are derived quantities which are calculated from measured quantities. For higher layers they may be considered as measurement results, therefore they are listed here.

Note 3: RSCP, ISCP, RSSI, SIR, Ec/No, UE Tx Power must be considered in specified timeslots (specified by the UTRAN which should take the UE capabilities into account). Especially the RSCP and ISCP or RSSI of SIR and Ec/No must be measured in the same timeslot.

6.1.1 RSCP

Definition	Received Signal Code Power, the received power on one code* in a specified timeslot after despreading. The reference point for the RSCP is the antenna connector at the UE.
Purpose	Cell selection and reselection (PCCPCH of own and neighbour cell, CPICH of neighbour FDD cell), HO evaluation (PCCPCH of own and neighbour cell, CPICH of neighbour FDD cell, DPCH, PDSCH), DL closed loop PC (DPCH, PDSCH), UL open loop PC (PCCPCH for pathloss), DCA (PCCPCH of own cell for pathloss calculation, DPCH and PDSCH for SIR).
Range/mapping	TBD.

*Since there is no power offset between the data part and the midamble for a code in a timeslot, it would be possible to measure RSCP either on the data part or on the midamble. However, to have a common reference the measurement on the midamble is assumed.

6.1.2 ISCP

Note that it is not a requirement that the ISCP shall be possible to report to higher layers. The ISCP is defined in this section because it is included in the definition of SIR and because SIR cannot be measured directly.

Definition	Interference Signal Code Power, the interference on the received signal in a specified timeslot after despreading. Only the non-orthogonal part of the interference is included in the measurement. The reference point for the ISCP is the antenna connector at the UE.
Purpose	HO evaluation (DPCH and PDSCH assigned to the UE), DCA (all DL timeslots specified by the UTRAN), DL closed loop PC (DPCH and PDSCH assigned to the UE)

Range/mapping	TBD <in most cases SIR will be reported to higher layers>

6.1.3 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth in a specified timeslot. The reference point for the RSSI is the antenna connector at the UE.
Purpose	Cell selection and reselection, inter system handover, load control.
Range/mapping	UTRAN: TBD. GSM: according to the definition of RXLEV in GSM 05.08.

6.1.4 SIR

Definition	Signal to Interference Ratio, defined as the RSCP divided by ISCP of the same timeslot. The reference point for the SIR is the antenna connector of the UE.
Purpose	DL closed loop power control (DPCH, PDSCH), handover evaluation (DPCH, PDSCH), DCA (DPCH, PDSCH), initial power setting
Range/mapping	TBD.

6.1.5 Ec/No

Definition	The received energy per chip divided by the power density in the band. The Ec/No is identical to RSCP/RSSI. The reference point for Ec/No is the antenna connector at the UE.
Purpose	Cell selection/reselection (CPICH for FDD cells), handover evaluation (CPICH for FDD cells).
Range/mapping	TBD.

6.1.6 Physical CH BER

Definition	The physical channel BER is an estimation of the average bit error rate (BER) before channel decoding of the data.
Purpose	Handover evaluation (DPCH)
Range/mapping	TBD.

6.1.7 Transport CH BLER

Definition	Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC on each transport block.
Purpose	DL closed loop power control (DPCH, PDSCH)

Range/mapping	TBD.

6.1.8 UE TX Power

Definition	The total UE transmitted power on one carrier measured in a timeslot. The reference point for the UE TX Power shall be the UE antenna connector.
Purpose	Monitoring if the average Tx power is reaching an upper or lower power limit, either connected to the UE capability or set by the network.
Range/mapping	TBD.

6.1.9 Observed time difference to target cell

Definition	Time difference in the frame timing between the serving TDD cell and the frame timing of the target cell (UTRA or non-UTRA cell)
Purpose	Cell selection and reselection, handover
Range/mapping	TBD

6.2 UTRAN measurement abilities

The following table provides an overview of the UTRAN measurement abilities:

Note: The term “Measurement target” refers to either physical channel(s), carrier, transport channel, channelisation code, etc.

No.	**Measurement ability**	**Measurement target where the measurement shall be possible (Idle mode= I / Connected mode = C)**	
		Intra-frequency	Inter-frequency
1	RSCP	For each UE: DPCH (C); PUSCH (C)	n.a..
2	ISCP	For all UL timeslots	n.a.
3	RSSI < =UL load in RAN WG2>	For each UL carrier	
4	SIR (=RSCP/ISCP)	For each UE: DPCH (C), PUSCH (C)	n.a.
5	Physical Channel BER	DPCH (C), PUSCH (C)	n.a.
6	Transport Channel BLER	DCH (C), USCH (C)	n.a.
7	UTRAN total TX Power	For all used DL carriers measured at UTRAN access point	
8	UTRAN TX Code Power < =UTRAN Code TX Power in RAN WG2>	For all used channelisation codes in all DL timeslots	
9	RX timing deviation	DPCH (C), PUSCH (C), PRACH	n.a.

Note 1: SIR is a derived quantity which is calculated from measured quantities. For higher layers SIR may be considered as measurement results, therefore it is listed here.

Note 2: RSCP, ISCP, RSSI, SIR, UTRAN total Tx Power, UTRAN TX code power must be considered in specified timeslots. Especially the RSCP and ISCP for SIR must be measured in the same timeslot.

6.2.1 RSCP

Definition	Received Signal Code Power, the received power on one code, i.e. midamble, in a specified timeslot after despreading. The reference point for the RSCP shall be the antenna connector of the UTRAN access point cabinet.
Purpose	HO evaluation (DPCH, PUSCH), DCA (DPCH and PUSCH for SIR calculation).
Range/mapping	TBD.

6.2.2 ISCP

Note that it is not a requirement that the ISCP shall be possible to report to higher layers. The ISCP is defined in this section because it is included in the definition of SIR and because SIR cannot be measured directly.

Definition	Interference Signal Code Power, the interference on the received signal in a specified timeslot after despreading. Only the non-orthogonal part of the interference is included in the measurement. The reference point for the ISCP shall be the antenna connector at the UTRAN access point cabinet.
Purpose	HO evaluation (measured on all UL timeslots), DCA (on all UL timeslots DPCH and PUSCH), UL open loop PC (on all UL timeslots)
Range/mapping	TBD <in most cases SIR will be reported to higher layers>

6.2.3 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the UTRAN UL channel bandwidth in a specified timeslot. The reference point for the RSSI shall be the antenna connector on the UTRAN access point cabinet.
Purpose	load control
Range/mapping	TBD

6.2.4 SIR

Definition	Signal to Interference Ratio, defined as the RSCP divided by ISCP of the same timeslot. The reference point for the SIR shall be the antenna connector on the UTRAN access point cabinet.
Purpose	handover evaluation (on all UL timeslots DPCH, PUSCH), DCA (on all UL timeslots DPCH, PUSCH)
Range/mapping	TBD.

6.2.5 Physical CH BER

Definition	The physical channel BER is an estimation of the average bit error rate (BER) before channel decoding of the data.
Purpose	Handover evaluation (DPCH and PUSCH)
Range/mapping	TBD.

6.2.6 Transport CH BLER

Definition	Estimation of the transport channel block error rate (BLER). The BLER estimation shall be based on evaluating the CRC on each transport block.
Purpose	DL closed loop power control (DPCH, PUSCH)
Range/mapping	TBD.

6.2.7 UTRAN Total Transmitted Power

Definition	UTRAN Total Transmitted Power, is the total transmitted power on one carrier from one UTRAN access point measured in a timeslot. The reference point for the UTRAN total transmitted power measurement shall be the antenna connector at the UTRAN access point cabinet
Purpose	Load control
Range/mapping	TBD.

6.2.8 UTRAN Transmitted Code Power

Definition	Transmitted Code Power, is the transmitted power on one carrier and one channelisation code in one timeslot. The reference point for the transmitted code power measurement shall be the antenna connector at the UTRAN access point cabinet.
Purpose	Power balancing between different radio links.
Range/mapping	TBD.

6.2.9 Received Timing Deviation

Definition	The difference of the time of arrival of the UL transmissions in relation to the arrival time of a signal with zero propagation delay.
Purpose	Timing Advance determination (PRACH, DPCH, PUSCH)
Range/mapping	TBD

7 Measurement monitoring for UTRA TDD

7.1 UE measurements

7.1.1 Overview of the different cell sets

<Editor's note: The different cell sets should finally be described in the WG2 specifications, see e.g. TS 25.331. However, this section should list the different sets with their purpose and give some references to the relevant WG2 specifications.

Since the cell sets for cell selection/reselection and handover in a TDD cell will probably be the same as in an FDD cell it has to be taken care that the text of 25.225 and 25.215 is consistent. Even if some doubling of idle mode description or handover monitoring set description is necessary.>

7.1.1.1 Cell selection/reselection

<Editor's note. Measurement to support cell selection and cell reselection rely on synchronisation acquisition procedures currently described in sections related to the Initial cell search procedures and Physical layer procedures (FDD) [4] and Physical layer procedures (TDD) [8] for FDD cells and TDD cells respectively.>

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.

7.1.1.1.1 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. The following two cases might be considered and would lead to two different kinds of cell selection monitoring 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.>

7.1.1.1.2 Cell reselection monitoring frequency or cell set

<WG1 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 as far as the FDD and TDD cell/frequencies are concerned.>

From a very general descriptive point of view, when in idle mode, the UE continuously searches for new cells on the current and other carrier frequencies. The measurement for the cell reselection are performed in basically the same way as the cell selection. The main difference compared to the cell selection is that a UE has received a priority list from the UTRAN, called the cell reselection monitoring set, which provides information relative to the cells to monitor.

As far as FDD cells are concerned, provision of the list significantly reduces 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.

<Editor's note : This last sentence might be misunderstood. The cell reselection monitoring list is most probably cell specific rather than UE specific.>

Content of the cell reselection monitoring set is further discussed in the following sections for FDD, TDD and GSM cells respectively.

7.1.1.1.2.1 Content of the cell reselection monitoring set for FDD cells

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

<Editor's note : It is to be confirmed that the list provides some indication of the order in which the cells have to be searched for.>

7.1.1.1.2.2 Content of the cell reselection monitoring set for TDD cells

The cell reselection monitoring set describes in which order to search for TDD cells.

<Editor's note : It is to be confirmed that the list provides some indication of the order in which the cells have to be searched for.>

7.1.1.1.2.3 Content of the cell reselection monitoring set for GSM cells

<Editor's note: to be added>

7.1.1.2 Handover

<WG1'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 higher layers. The primitives that allow the higher layers to control the measurement process in the layer 1 are under definition by the RAN WG2.>

<Editor's note : To illustrate the WG1's note before we would say that several cases might be considered :

- *the MAC has a very fine control of the measurement, up to the frame level, decides on the measurement of particular cells at particular instant and the physical layer report measurements back to the MAC layer e.g. after a compressed 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. compressed 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. If the first case has to be considered in the future then some material of the section would need to be moved to the relevant RAN WG2 documentation.>

7.1.1.2.1 Overview of the different sets

The physical layer of the UE should be provided 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 UE, which corresponds to the cell between which the UE in a soft 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.

<Editor's note: Since the scope of this specification to the measurement only, there might not be a need to define the same sets. Only sets 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 cells are measured for each frame, whereas cells which are not part of the active set are not measured as often as every frame. Cells which have been identified by the higher layers as candidate cell may need to be measured more often than other cells, since they are among the x strongest.>

7.1.1.2.2 Content of the sets

7.1.1.2.2.1 Handover monitoring set

The handover monitoring set contains the cells to be monitored by the UE in connected mode. It is provided to the physical layer by higher layers, as part of the primitives. 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.

7.1.1.2.2.1.1 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:

- SFN measurement indicator which indicates whether the UE should read SFN of the target cell or not.
- 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 with the code grouping being determined beforehand.

Additionally there can be the following information on the UTRANs where timing information between cells is used:

- The relative timing difference between the cell transmitting the handover monitoring list and each neighbouring cell on the same frequency.
- The estimated accuracy of the timing difference indication.

This can be given for example in the following format:

Example of the timing information with 16 bits reserved for the message.

Code	Measurement accuracy (step)	Estimate of timing difference
00	40 chips	0 to 38400 chips steps of 40 chips
01	256 chips (1/10 slots)	0 to 38400 chips in steps of 256 chips
10	2560 chips (1 slot)	0 to 38400 chips in steps of 2560 chips
11	More than 2560 chips	

<Editor's note : This may be better described in the WG2 documentation. Some text may be however useful here for explanatory purposes>

7.1.1.2.2.1.2 FDD cells on different frequencies

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

- The cell scrambling code used for downlink scrambling.
- The cell ID number
- The carrier centre frequency of the cell

Additionally there can be the following information on the UTRANs where timing information between cells is used:

- The relative timing difference between the cell transmitting the handover monitoring list and each neighbouring cell.
- The estimated accuracy of the timing difference indication.

7.1.1.2.2.1.3 TDD cells

The handover monitoring set contains for each cell to monitor:

- the carrier center frequency information
- an information field for the cell parameters (t_{offset}, basic midamble code, scrambling code)
- the timeslot number of the PCCPCH
- Observed time difference of the target cell if available

Each UE has stored a 'cell parameter list' which maps the information field value to one out of 128 sets of cell parameters. The list is common to all TDD systems and is described in TS 25.223.

7.1.1.2.2.1.4 GSM cells

<Editor's note : A reference to the GSM specification should be added here.>

7.1.1.2.2.2 Active set

<Editor's note: This set is used to administer the cells to which an UE is in soft handover. Therefore this set is not used when camping on a TDD cell.>

7.1.1.2.2.3 Candidate set

<Editor's note : to be added>

7.1.2 Measurements for Handover

For the preparation of a handover from TDD the UE measures in its idle timeslots the received power of other cells. A mechanism that introduces idle timeslots on demand is for further study.
For the search for other cells the UE is provided by a handover monitoring set by the UTRAN.

In addition to the measurements described for neighbouring cells, the UE shall measure for the serving TDD cell:

1. Rx ISCP on the DL timeslots assigned to the UE
2. Rx RSCP on the DPCH, PDSCH and PCCPCH

7.1.2.1 Monitoring of TDD cells

During the measurement process the UE shall find synchronisation to the cells to measure using the synchronization channel with the primary and the secondary synchronization code as well as the information contained in the cell parameter list. After this procedure the exact timing of the midamble of the PCCPCH is known and the measurements can be performed.
Depending on the UE implementation and if timing information about the cell to monitor is available, the UE may perform the measurements on the PCCPCH directly without prior SCH synchronisation.

The UE shall measure and report to the higher layers from the monitored TDD cells on the same frequency, belonging to the handover monitoring set, the following quantities:

1. Rx RSCP on PCCPCH
2. Observed time difference to target TDD cell

7.1.2.2 Monitoring of FDD cells

The UE shall measure and report to the higher layers from the FDD cells, belonging to the handover monitoring set, the following quantities:

1. Ec/No on CPICH, that means RSCP of CPICH and RSSI of the corresponding carrier

2. Observed time difference to target FDD cell

7.1.2.3 Monitoring of GSM cells

UTRA/TDD-GSM dual mode terminals 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 TDD channels rely on similar 120 ms multi-frame structure.

A UE can do the measurements by efficiently using idle slots (slot left idle between Tx and Rx and/or Rx and TX as a result of the resource allocation. Other alternatives, e. g. dual receiver, are for further study). Basic requirements to correctly perform a handover in GSM are described in GSM 05.08 “Radio subsystem link control”.

Two kinds of UE should be distinguished: A single synthesiser UE has to switch in its idle periods from the TDD frequency to the considered GSM frequency, monitor GSM and switch back to TDD afterwards, that means two times a synthesiser switching time has to be considered. A dual synthesiser UE avoids this synthesiser switching time and the monitoring periods are equal to the idle periods.

For preparation of a handover from TDD to GSM two procedures are possible:

- To detect at first the FCCH burst and then the SCH burst (following one GSM frame later)

- or searching parallel for FCCH and SCH bursts.

7.1.2.4 Overall handover preparation at the UE

<Editor’s note: This section will have some RAN WG2 aspects>

This section should explain how the inter-frequency handover preparation from UTRA TDD to UTRA (either FDD or TDD) and from UTRA to GSM is co-ordinated in terms of measurement and reporting at the UE. This section provides the overall requirement and measurement procedure.

7.1.3 Measurements for Cell Selection/Reselection

7.1.4 Measurements for DCA

DCA is used to optimise the resource allocation by means of a channel quality criteria or traffic parameters. The DCA measurements are configured by the UTRAN.

The UE reports the measurements to the UTRAN.

For DCA no measurements are performed in idle mode in the serving TDD cell.

7.1.4.1 Measurements by the UE for DCA when connecting

With the initial access the UE immediately starts measuring the ISCP of time slots which are communicated on the BCH. The measurements and the preprocessing are done while the UTRAN assigns an UL channel for the UE for signaling and measurement reporting.

7.1.4.2 Measurements by the UE for DCA when in connected mode

In order to support DCA the UE shall measure and report to higher layers any of the quantities:

1. Rx ISCP on DL timeslots according to a list provided by the UTRAN

2. Rx RSCP on the serving DPCHs and PDSCH (for SIR calculation) and on the PCCPCH (for pathloss calculation)

In connected mode the UE monitors the link quality (e.g. SIR, BER) of *the used* timeslots and reports them to the UTRAN (the reporting trigger, i.e. periodic or on demand or event triggered, is determined by the UTRAN, see 25.302).

If quality falls below a certain threshold also the ISCP on *all other* timeslots specified by the network is measured and reported to UTRAN together with the quality values and pathloss loss indicator. That means the falling below a certain threshold triggers the periodic reporting to UTRAN.

With these measurements the UTRAN can react on fluctuations of the interference in timeslots and reshuffle the timeslot allocation.

7.2 UTRAN measurements

<Editor's note : 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 >

7.2.1 Measurements for Timing Advance

To update timing advance of a moving UE the UTRAN measures 'Received Timing Deviation', i.e. the time difference of the received UL transmission (PRACH, DPCH, PUSCH) in relation to its timeslot structure that means in relation to the ideal case where an UL transmission would have zero propagation delay. The measurements are reported to higher layers, where timing advance values are calculated and signalled to the UE.

The following measurement has to be performed by the UTRAN on PRACH, DPCH and PUSCH if timing advance is used in this TDD cell:

1. Rx Timing deviation

7.2.2 Measurements for Handover

For the handover preparation in a TDD cell the serving nodeB shall carry out the following measurements:

1. Rx RSCP on DPCH and PUSCH
2. Rx ISCP on all uplink timeslots
3. Physical channel BER on DPCH and PUSCH
4. UTRAN total TX power in downlink

7.2.3 Measurements for DCA

The following measurements have to be performed for DCA at the UTRAN side and reported to higher layers:

1. Rx ISCP on all UL timeslots
2. Rx RSCP on all timeslots DPCH and PUSCH

8 Annex A

8.1 Monitoring GSM from TDD: Calculation Results

<WG1's note : The following subsections reflect current working assumptions but due to their descriptive nature they should not be included in the final version of the specification, but may be in a technical report.>

8.1.1 Low data rate traffic using 1 uplink and 1 downlink slot

<WG1's note : The section evaluates the time to acquire the FCCH if all idle slots are devoted to the tracking of a FCCH burst, meaning that no power measurements is done concurrently. The derived figures are better than those for GSM. The section does not derive though any conclusion. A conclusion may be that the use of the idle slots is a valid option. An alternative conclusion may be that this is the only mode to be used, removing hence the use of the slotted frames for low data traffic or the need for a dual receiver, if we were to considering the monitoring of GSM cells only, rather than GSM, TDD and FDD.>

If a single synthesiser UE uses only one uplink and one downlink slot, e.g. for speech communication, the UE is not in transmit or receive state during 13 slots in each frame. According to the timeslot numbers allocated to the traffic, this period can be split into two continuous idle intervals A and B as shown in the figure below.

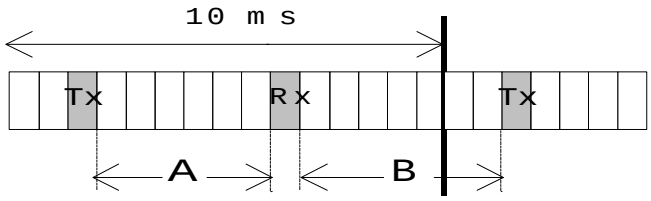

Figure: Possible idle periods in a frame with two occupied timeslots.

A is defined as the number of idle slots between the Tx and Rx slots and B the number of idle slots between the Rx and Tx slots. It is clear that A+B=13 time slots.

In the scope of low cost terminals, a [0.8] ms period is supposed to be required to perform a frequency jump from UMTS to GSM. This lets possibly two free periods of A*Ts-1.6 ms and B*Ts-1.6 ms during which the mobile station can monitor GSM, Ts being the slot period.

Following table evaluates the average synchronisation time and maximum synchronisation time, where the announced synchronisation time corresponds to the time needed to find the FCCH. The FCCH is supposed to be perfectly detected meaning that the FCCH is found if it is entirely present in the monitoring window. The FCCH being found the SCH location is unambiguously known from that point. All the 13 idle slots are assumed to be devoted to FCCH tracking and the UL traffic is supposed to occupy the time slot 0.

Downlink time slot number	Number of free TS in A	Number of free TS in B	Average synchronisation time (ms)	Maximum synchronisation time (ms)
1	0	13	44	140
2	1	12	50	187
3	2	11	58	188
4	3	10	66	189
5	4	9	70	233
6	5	8	77	234
7	6	7	75	189
8	7	6	75	189
9	8	5	75	235
10	9	4	67	235

11	10	3	63	186
12	11	2	56	186
13	12	1	49	186
14	13	0	43	132

Table: example- of average and maximum synchronisation time with two busy timeslots per frame and with 0.8 ms switching time (*).

(*) All simulations have been performed with a random initial delay between GSM frames and UMTS frames

Each configuration of TS allocation described above allows a monitoring period sufficient to acquire synchronisation.

8.1.2 Higher data rate trafic using more than 1 uplink and/or 1 downlink TDD timeslot

The minimum idle time to detect a complete FCCH burst for all possible alignments between the GSM and the TDD frame structure (called 'guaranteed FCCH detection'), assuming that monitoring happens every TDD frame, can be calculated as follows (t_{FCCH} = one GSM slot):

$$t_{\min,\,guaranteed} = 2 \times t_{synth} + t_{FCCH} + \frac{10\text{ms}}{13} = 2 \times t_{synth} + \frac{35\text{ms}}{26}$$

(e.g for t_{synth} =0ms: 3 TDD **consecutive** idle timeslots needed, for t_{synth} =0,3ms: 3 slots, for t_{synth} =0,5ms: 4 slots, for t_{synth} =0,8ms: 5 slots). Under this conditions the FCCH detection time can never exceed the time of 660ms.

(For a more general consideration t_{synth} may be considered as a sum of all delays before starting monitoring is possible.)

For detecting SCH instead of FCCH (for a parallel search) the same equation applies.

In the equation before the dual synthesiser UE is included if the synthesiser switching time is 0ms.

occupied slots= 15-idle slots	cases	FCCH detection time in ms	
		Average	maximum
2	105	37	189
3	455	46	327
4	1365	58	419
5	3003	72	501
6	5005	90	646
7	6435	114	660
8	6435	144	660
9	5005	175	660
10	3003	203	660
11	1365	228	660
12	455	254	660
13	105	-	-
14	15	-	-

Table : FCCH detection time for a dual synthesizer UE monitoring GSM from TDD every TDD frame

In the table above for a given number of occupied slots in the TDD mode all possible cases of distributions of these occupied TDD slots are considered (see 'cases'). For every case arbitrary alignments of the TDD and the GSM frame structure are taken into account for calculating the average FCCH detection time (only these cases are used which guarantee FCCH detection for all alignments; only the non-parallel FCCH search is reflected by the detection times in the table 2).

The term ‘occupied slots’ means that the UE is not able to monitor in these TDD slots.

For a synthesiser switching time of one or one half TDD timeslot the number of needed consecutive idle TDD timeslots is summarized in the table below:

One-way switching time for the synthesiser	Number of free consecutive TDD timeslots needed in the frame for a guaranteed FCCH detection
1 TS (=2560 chips)	5
0.5 TS (=1280 chips)	4
0 (dual synthesiser)	3

Table: Link between the synthesiser performance and the number of free consecutive TSs for guaranteed FCCH detection, needed for GSM monitoring

8.1.3 Use of TDD TSs release to accommodate monitoring windows

In high data-rate, when it is not possible to free the number of TS needed for an effective monitoring to prepare a handover from UMTS to GSM, the data rate can be slightly reduced for the duration of the monitoring. This should be acceptable as in any case, the data rate needs to be adapted to the available resource in GSM before the handover can be performed.

9 Restructuring of the original TS 25.231 v0.3.1

<This chapter can be removed in future versions of the new specification TS 25.225.>

The following paragraphs in the original 25.321 v0.3.1 have been deleted, modified or moved to another section:

Paragraph in 25.231 v0.3.1	**Comment (what was done with the paragraph)**
5.1.1	Moved to 7.1.1.1, minor editorial changes (e.g. to wrong references)
5.1.2	Measurements moved to 6.
5.2.1	Moved to 7.1.1.1, minor editorial changes (e.g. to wrong references)
5.2.2	Measurements moved to 6.
6	‘Measurements at call set-up’: includes DCA measurements and is moved to 7.1.4
7.1.1	Moved to 7.1.1.2, text of R1-99a79 added
7.1.2	‘Measurement triggering criteria’ removed. Not a WG1 but a WG2 issue.
7.1.3	FDD section removed
7.1.4	FDD section removed
7.1.5.1	Empty, deleted
7.1.5.2	Moved to 7.1.2.1, text of R1-99a79 included
7.1.5.3	Moved to 7.1.2.2, text of R1-99a79 included
7.1.5.4.1	Moved to 7.1.2.3
7.1.5.4.2	Moved to 7.1.2.3
7.1.5.4.2.1	Moved to annex A 8.1 since it is informative text, modifications according to R1-99c22, R1-99d62
7.1.5.4.2.2	Moved to annex A 8.1 since it is informative text, modifications according to R1-99c22
7.1.5.4.2.3	Moved to annex A 8.1 since it is informative text
7.1.5.4.3	Wrong section number in 25.231 v0.3.1, moved to 7.1.2.4
7.1.6	Moved to 7.2
7.1.7	Wrong section title (also contains FDD text) and wrong subsection numbers in 25.231 v0.3.1; FDD parts deleted and rest moved to 5.
7.2	‘Measurement for cell reselection in active mode’, section not needed, editor’s note deleted,

Paragraph in 25.231 v0.3.1	Comment (what was done with the paragraph)
	contents (one descriptive sentence) moved to 7.1.1.1
7.3	'Measurement for power control' was interpreted as power control measurements reported over the radio; empty section, deleted
7.4.1	Moved to 7.1.4, modified according to R1-99a79
7.4.2	Moved to 7.2.3, modified according to R1-99a79
7.5	'Measurements on adjacent channels': not needed(?)
7.6	'Measurements for radio-link time-out (or sync loss)': empty section, deleted
8	'Radio Link Measurements': measurement quantities defined in 6.
Annex 1	Handover scenarios. Completely removed, not a WG1 issue.
Annex 2	Handover execution. Completely removed.

10 History

V.0.0.1	01.09.1999	First version of 'TS 25.225 Physical Layer – Measurements (TDD)' based on 'TS 25.231 Physical Layer – Measurements' V0.3.1 of 11.08.1999 approved in RAN WG1 meeting #6 including the agreed text proposals R1-99c22, R1-99a79 (with changes) and R1-99d62
V.0.1.0	03.09.1999	TS 25.225 Physical Layer – Measurements (TDD) V.0.0.1 approved in RAN WG1 meeting #7 agreeing the measurements in section 6 marked by # and therefore deleting the corresponding notes. Furthermore, adding a section 'Measurements for Cell Selection/Reselection' after section 7.1.2 and therefore updating the table in chapter 9.
The editor for TS 25.225 Physical Layer – Measurements is Xy Xy Phone: , fax: , email: This document is written in Microsoft Word 97.		