TSG-RAN Working Group 1 meeting #7 **TSGR1#7(99) d90**
Hanover, Germany, August 30 – September 3, 1999

Agenda Item : **adhoc 16 (Measurements)**

Source : drafting group

Title : Proposal for new specification ŤS 25.215 Physical Layer – Measurements (FDD)'based on TS 25.231

Document for : approval

Introduction

After some discussion in adhoc 16 (see Tdocs [1] and [2]), it was decided that:

- Two new specification documents should be generated.
- The scope of the specifications will follow the structure in (99)c97, with the exception that filtering is left out and that derived measurements like SIR are included.
- Before the end of this meeting, the new specifications should be progressed as much as possible, including creating a document with the correct structure, copy existing information to be kept from 25.231, and including text proposals agreed for 25.231.
- The goal for this meeting is to get some first versions of the new specifications approved by R1, and then improve and approve the documents using the email reflector in time for the next TSG RAN meeting.

Therefore, the specification 'TS 25.231 Physical Layer – Measurements' is split into an FDD part 'TS 25.215 Physical Layer – Measurements (FDD)' and a TDD part 'TS 25.225 Physical Layer – Measurements (TDD)'.

This Tdoc contains the FDD part 'TS 25.215 Physical Layer – Measurements (FDD)' which is based on TS 25.231 v.0.3.1 [3] and also includes the agreed changes of adhoc 1, 8, 16, 17 of the Tdocs [4] to [12].

References

[1] RAN WG1 Tdoc (99) b26, Proposal for new measurement specification, source: Ericsson

[2] RAN WG1 Tdoc (99) c97, Proposal for Restructuring the TDD Parts of the Measurement Specification, source: Siemens

[3] RAN WG1 Tdoc (99) a70, TS 25.231 v0.3.1 Physical Layer Measurements, source: editor

[4] RAN WG1 Tdoc (99) a79, Physical Layer Measurements in UTRA TDD Mode, source: Siemens

[5] RAN WG1 Tdoc (99) b22, Required UTRAN measurements in UTRA/FDD, source: Ericsson

[6] RAN WG1 Tdoc (99) b23, Required UE measurements in UTRA/FDD, source: Ericsson

[7] RAN WG1 Tdoc (99) b24, Additional required measurements in UTRA/FDD, source: Ericsson

[8] RAN WG1 Tdoc (99) b25, Path delay measurement, source: Ericsson

[9] RAN WG1 Tdoc (99) b14, Textproposal for Compressed Mode Parameters for GSM Search, source: Mitsubishi, Nokia , Siemens

[10] RAN WG1 Tdoc (99) b98, Compressed Mode for FDD-FDD Handover preparation, source: Mitsubishi Electric

[11] RAN WG1 Tdoc (99) d18, Compressed mode for GSM measurements, revised, source: Nokia

[12] RAN WG1 Tdoc (99) 901, Text proposal for LCS, source: Ericsson

TS 25.215 V0.0.1 (1999-09)

Technical Specification

3rd Generation Partnership Project (3GPP); Technical Specification Group (TSG) Radio Access Network (RAN); Working Group 1 (WG1); Physical layer – Measurements (FDD)

Reference

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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

3 Scope

< Editor's note: This section needs to be updated once the scope of the document is determined. >

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

5 Control of UE/UTRAN measurements

<Editors 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 are defined, where higher layers controls what to measure, how often to measure, when to report (criteria), filtering of measured value.>

6 Measurement abilities for UTRA FDD

<Editors note: In this chapter definitions of measurements required by WG2, L1 measurements reported to higher layers, shall be made. Maybe also UE internal measurements (not reported over the air-interface shall be defined?>

<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.>

~~1.1~~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.

Measurement ability	**Measurement target on which the measurement shall be possible (Idle mode= I / Connected mode = C)**	
	Intra-frequency	Inter-frequency
RSCP	CPICH (I/C), DPCH measured on DPCCH	CPICH (I/C)

Measurement ability	**Measurement target on which the measurement shall be possible (Idle mode= I / Connected mode = C)**	
	Intra-frequency	Inter-frequency
	for each RL and after RL combination (C)	
SIR	DPCH measured on DPCCH for each RL and after RL combination (C)	n.a.
RSSI	UTRAN DL carrier (I/C)	UTRAN DL carrier (I/C), GSM BCCH carrier (I/C).
Ec/No	CPICH (I/C), DPCH measured on DPCCH for each RL and after RL combination (C)	CPICH (I/C)
Transport CH BLER	Transport channel DCH carried by physical channel DPCH after RL combination (C)	n.a.
Physical CH BER	Transport channel DCH carried by physical channel DPCH after RL combination (C)	n.a.
UE TX Power	DPCCH/DPDCH (C)	n.a.
Relative Timing Difference Between Cells	CPICH (C)	n.a.
UE RxTx timing	DPCH (C)	n.a.
Relative Timing Difference Between Cells for LCS	CPICH (TBD.)	CPICH (TBD.)

~~1.1.1~~6.1.1 RSCP

Definition	Received Signal Code Power, the received power on one code after de-spreading measured on the pilot bits. The reference point for the RSCP is the antenna connector at the UE.
Purpose	Handover evaluation (CPICH of own and neighbour cells), DL open loop power control (DPCCH), calculation of SIR (DPCCH) pathloss (CPICH of own and neighbour cells).
Range/mapping	TBD.

~~1.1.2~~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 beacuse it is included in the definition of SIR.

Definition	Interference Signal Code Power, the interference on the received signal after de-spreading. 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	Calculation of SIR (DPCCH).

~~1.1.3~~6.1.3 SIR

Definition	Signal to Interference Ration, defined as the RSCP divided by ISCP. The reference point for the SIR is the antenna connector of the UE.
Purpose	DL inner/outer loop power control (DPCCH), DL open loop power control (DPCCH), initial power setting (DPCCH).
Range/mapping	TBD.

~~1.1.4~~6.1.4 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth. The reference point for the RSSI is the antenna connector at the UE.
Purpose	Inter system handover (GSM BCCH carrier), load control (UTRAN DL carrier).
Range/mapping	UTRAN: TBD. GSM: according to the definition of RXLEV in GSM 05.08.

~~1.1.5~~6.1.5 Ec/No

Definition	The recieved 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/re-selection (CPICH of own and neighbour cells), handover evaluation (CPICH of own and neighbour cells).
Range/mapping	TBD.

~~1.1.6~~6.1.6 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	Outer loop power control (transport channel DCH).
Range/mapping	TBD.

~~1.1.7~~6.1.7 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	Outer loop power control (DPCH).
Range/mapping	TBD.

~~1.1.8~~6.1.8 UE TX Power

Definition	The total UE transmitted power on one carrier measured on DPCCH/DPDCH. 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 (DPCCH/DPDCH).
Range/mapping	TBD.

~~1.1.9~~6.1.9 Relative Timing Difference Between Cells

Definition	The relative timing difference between cells T_m is defined as $T_m = \lfloor T_{UETx} - T_o - T_{CPICH} \rfloor$ where: - T_{UETx} is the time when the UE transmits an uplink DPCCH/DPDCH frame. - T_o is a constant timing offset between the first received DPCH frame in the UE and the following uplink DPCCH/DPDCH frame. T_o is used to set up the transmission frame timing in the UE and given in number of chips. - T_{CPICH} = the time for the earliest received downlink CPICH path of the target cell in the UE.
Purpose	Cell timing measurement for soft handover (CPICH of neighbour cells).
Range/mapping	T_m is an absolute value and is therefore always positive. T_m is given in chip units and has a range of [0~~38~~400-1] chips.

~~1.1.10~~6.1.10 UE RxTx timing

Definition	The difference in time between the UE uplink DPCCH/DPDCH frame transmission and the first significant path, of the downlink DPCH frame from the measured radio link. Measurement shall be made for each cell included in the active set. Note: The definition of "first significant path" needs further elaboration.
Purpose	Estimation of the path delay and the distance between and UTRAN access point and the UE (DPCH).
Range/mapping	Always positive.

~~1.1.11~~6.1.11 Relative Timing Difference Between Cells for LCS

Definition	The relative timing difference between the serving cell and cell i. T_{LCSi} is defined as $T_{LCSi} = T_{CPICHRxi} - T_{CPICHRx0}$, where: $T_{CPICHRx0}$ is the time when the UE receives one CPICH slot from the serving cell $T_{CPICHRxi}$ is the time when the UE receives the CPICH slot from cell i that is closest in time to the CPICH slot received from the serving cell
Purpose	Location services (CPICH of own and neighbour cells)
Range/mapping	T_{LCS} is a signed value. The resolution of T_{LCS} is 0.5 chip and the range is [-12791280] chips.

~~1.2~~6.2 UTRAN 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.

Measurement ability	**Measurement target on which the measurement shall be possible (Idle mode= I / Connected mode = C)**	
	Intra-frequency	Inter-frequency
RSSI	UTRAN UL carrier	
SIR	DPCCH/DPDCH measured on DPCCH after RL combination in Node B (C)	n.a.
Total Transmitted Power	Any carrier transmitted from an UTRAN access point	
Transmitted Code Power	Any channelisation code transmitted from an UTRAN access point	
Transport CH BLER	Transport channel DCH carried by physical channel DPDCH after RL combination in Node B (C)	n.a.
Physical CH BER	Transport channel DCH carried by physical channel DPDCH after RL combination in Node B (C)	n.a.
Round Trip Delay (RTD)	DPCH for each RL transmitted from an UTRAN access point and DPDCH/DPCCH for each RL received in an UTRAN access point (C)	n.a.

~~1.1.1~~6.2.1 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the UTRAN uplink channel bandwidth in an UTRAN access point. The reference point for the RSSI measurements shall be the antenna connector on the UTRAN access point cabinet.
Purpose	Load control (UTRAN uplink carrier), initial power setting of uplink physical channels (UTRAN uplink carrier).
Range/mapping	TDB.

~~1.1.2~~6.2.2 SIR

Definition	Signal to Interference Ratio, is defined as the RSCP divided by the ISCP. The reference point for the SIR measurements shall be the antenna connector on the UTRAN access point cabinet.
Purpose	Power control (DPCCH), macro diversity evaluation (DPCCH).
Range/mapping	TBD.

~~1.1.3~~6.2.3 Total Transmitted Power

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

~~1.1.4~~6.2.4 Transmitted Code Power

Definition	Transmitted Code Power, is the transmitted power on one carrier and one channelisation code. 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 (any channelisation code transmitted from an UTRAN access point).
Range/mapping	TBD.

~~1.1.5~~6.2.5 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	Handover evaluation (transport channel DCH), outer loop power control (transport channel DCH).
Range/mapping	TBD.

~~1.1.6~~6.2.6 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	Macrodiversity combining (DPDCH), outer loop power control (DPDCH).
Range/mapping	TBD.

~~1.1.7~~6.2.7 Round Trip Delay (RTD)

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

Definition	Round Trip Delay (RTD), is defined as $RTD = T_{RX} - T_{TX}$, where T_{TX} = The time of transmission of the beginning of a downlink DPCH frame to a UE. T_{RX} = The time of reception of the beginning (the first significant path) of the corresponding uplink DPCCH/DPDCH frame from the UE. Note: The definition of "first significant path" needs further elaboration.
Purpose	Estimation of the path delay and the distance between a UTRAN access point and the UE (DPCH, DPDCH/DPCCH).
Range/mapping	TBD.

7 Measurements for UTRA FDD

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.>

~~1.1.1.1~~7.1.1.1 Cell selection/reselection

<Editorś note. 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.>

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. Two following two cases might be considered and would lead to two different 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.*

>

~~1.1.1.1.2~~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 re-selection 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.

~~1.1.1.1.1.1~~7.1.1.1.2.1 Content of the cell reselection monitoring set for FDD cells

The content of the cell re-selection 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. >

~~1.1.1.1.1.2~~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. >

~~1.1.1.1.3~~7.1.1.2.3 Content of the cell reselection monitoring set for GSM cells

To be added

~~1.1.1.2~~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, 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 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 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.

>

~~1.1.1.1.1~~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 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 measured 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 higher layers as candidate cell may need to be measured more often than other cell, since they are among the x strongest. >

~~1.1.1.1.2~~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 (see [8]). 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.

~~1.1.1.1.1.1.1~~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>

~~1.1.1.1.1.2~~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.

~~1.1.1.1.1.3~~7.1.1.2.2.1.3 TDD cells

~~The handover monitoring set contains for each TDD cell to monitor a frequency information and an information field CELL_PARAM for the cell parameters (t_{offset}, long basic midamble code, short basic midamble code, scrambling code).~~

~~Each UE has stored a ćell parameter list'(see table below) for the TDD carrier which is common to the whole network and which contains 128 sets of cell parameters.~~

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 ćell parameter list'which maps the information field value 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.

~~Each set has a unique long basic midamble code, a unique short basic midamble code (optional) and a unique scrambling code. Furthermore, each set has a t_{offset} out of 32 different values.~~
~~The information whether a long or a short basic midamble code is used for specific resources is configured by the UTRAN, e.g. BCH may be used.~~

CELL_PARAM	Long basic midamble	Short basic midamble	Scrambling code	t_{offset}
0	m_{PL0} (see m_P in [5])	m_{PS0} (see m_P in [5])	Code 0	t_0
1	M_{PL1}	m_{PS1}	Code 1	
2	M_{PL2}	m_{PS2}	Code 2	
3	M_{PL3}	m_{PS3}	Code 3	
4	M_{PL4}	m_{PS4}	Code 4	t_1
5	M_{PL5}	m_{PS5}	Code 5	
6	M_{PL6}	m_{PS6}	Code 6	
7	M_{PL7}	m_{PS7}	Code 7	
. . .				
124	m_{PL124}	m_{PS124}	Code 124	t_{31}
125	m_{PL125}	m_{PS125}	Code 125	
126	m_{PL126}	m_{PS126}	Code 126	
127	m_{PL127}	m_{PS127}	Code 127	

Table - :

~~Note: Similar timing information as for the FDD could be provided for TDD cells as well to aid the FDD-TDD handover as TDD BCCH occurs only during two slots, thus measurements with timing information will be faster.~~

~~1.1.1.1.1.1.4~~7.1.1.2.2.1.4 GSM cells

<editor's note : to be added>

~~1.1.1.1.1.2~~7.1.1.2.2.2 Active set

<editor's note : to be added>

~~1.1.1.1.1.3~~7.1.1.2.2.3 Candidate set

<editors̀ note : to be added>

~~1.1.2~~7.1.2 Compressed mode

7.1.2.1 Use of compressed mode/dual receiver for monitoring

A UE shall, on upper layers commands, monitor cells on other frequencies (FDD, TDD, GSM). To allow the UE to perform measurements, upper layers shall command that the UE enters in compressed mode, depending on the UE capabilities.

In case of compressed mode decision, UTRAN shall communicate to the UE the parameters of the compressed mode, described in reference [2], 25.212.

A UE with a single receiver shall support downlink compressed mode.

Every UE shall support uplink compressed mode, when monitoring frequencies which are close to the uplink transmission frequency (i.e. frequencies in the TDD or GSM 1800/1900 bands).

All fixed-duplex UE shall support both downlink and uplink compressed mode to allow inter-frequency handover within FDD and inter-mode handover from FDD to TDD.

< WG1's note : the use of uplink compressed mode for single receiver UE when monitoring frequencies outside TDD and GSM 1800/1900 bands is for further study >

UE with dual receivers can perform independent measurements, with the use of a "monitoring branch" receiver, that can operate independently from the UTRA FDD receiver branch. Such UE do not need to support downlink compressed mode.

The following section provides rules to parametrise the compressed mode.

~~1.1.1.2~~7.1.2.2 Parameterisation of the compressed mode

In response to a request from upper layers, the UTRAN shall signal to the UE the compressed mode parameters.

The following parameters characterize a transmission gap :

- TGL : Transmission Gap Length is the duration of no transmission, expressed in number of slots (e.g. used for switching frequency, monitoring).
- SFN : The system frame number when the transmission gap starts
- SN : The slot number when the transmission gap starts

With this definition, it is possible to have a flexible position of the transmission gap in the frame, as defined in [2].

The following parameters characterize a compressed mode pattern :

- TGP : Transmission Gap Period is the period of repetition of a set of consecutive frames containing up to 2 transmission gaps (*).
- TGL : As defined above
- TGD : Transmission Gap Distance is the duration of transmission between two consecutive transmission gaps within a transmission gap period, expressed in number of frames. In case there is only one transmission gap in the transmission gap period, this parameter shall be set to zero.
- PD: Pattern duration is the total time of all TGPs expressed in number of frames.
- SFN : The system frame number when the first transmission gap starts

In a compressed mode pattern, the first transmission gap starts in the first frame of the pattern. The gaps have a fixed position in the frames, and start in the slot position defined in [2].

(*) : Optionally, the set of parameters may contain 2 values TGP1 and TGP2, where TGP1 is used for the 1st and the consecutive odd gap periods and TGP2 is used for the even ones. Note if TGP1=TGP2 this is equivalent to using only one TGP value.

In all cases, upper layers has control of individual UE parameters. The repetition of any pattern can be stopped on upper layers command.

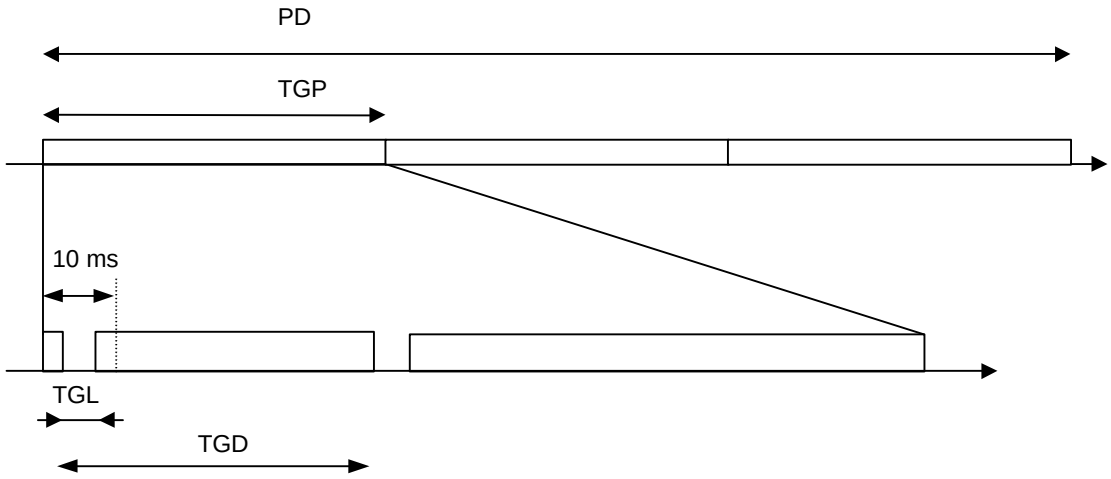

Figure 1 : illustration of compressed mode pattern parameters

~~1.1.3~~7.1.3 Measurements for Handover

7.1.3.1 Monitoring of FDD cells on the same frequency

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.

~~1.1.1.2~~7.1.3.2 Monitoring cells on different frequencies

7.1.3.2.1 Monitoring of FDD cells on a different frequency

Upper layers may ask FDD UE to perform preparation of inter-frequency handover to FDD. In such case, the UTRAN signals to the UE the handover monitoring set, and ~~the~~ if needed, the compressed mode parameters used to make the needed measurements. Setting of the compressed mode parameters defined in section 7.1.2.2~~7.1.3.3.2~~ for the preparation of handover from UTRA FDD to UTRA FDD is indicated in the following section. The compressed mode for IFHO preparation from UTRA-FDD to UTRA-FDD has two different modes. One is "selection-mode". The UE must identify the cell during this mode. The other is "reselection-mode". The UE measures signal strength by the scrambling code already known. Selection mode / reselection mode parameter sets are described in section 7.1.3.2.1.1~~3.4.1~~ / 7.1.3.2.1.2~~3.4.2~~ respectively.

Measurements to be performed by the physical layer is defined in section ~~6~~7.1.1.3.3.4.2.

~~1.1.1.1.1.1~~7.1.3.2.1.1 Setting of the compressed mode parameters for selection mode

During the transmission gaps, the UE shall perform measurements so as to be able to report to the UTRAN the frame timing, the scrambling code and the Ec/Io of Primary CCPCH of up to the [x] FDD cells in the handover monitoring set.

<Editor's note : the sentence before is inconsistent with the following section. This inconsistency needs to be solved>

When compressed mode is used for cell acquisition at each target FDD frequency, the parameters of compressed mode pattern are fixed to be :

	TGL	TGD	TGP1	TGP2	PD
Pattern1	7	24/15	4	20	M
Pattern2	7	24/15	4	140	M
Pattern3	7	2	4	Not Used	M
Pattern4	7	2	4	20	M
Pattern5	7	2	4	140	M
Pattern6	14	3	6	18	M
Pattern7	14	3	6	138	M

<Note1: Frame method and transmission gap position of each pattern will be proposed in R1-99b99>

<Note2: The frequency switching time required for UE is assumed to be 666us (equal to the slot duration) which includes implementation margin. This assumption means UE will consume 1slot of TGL for frequency switching (go and return) time.>

7.1.3.2.1.2 Setting of the compressed mode parameters for reselection mode

This parameter sets are used for UE which has already known scrambling code. UTRAN indicate which pattern will be used by UE.. According to the result during reselection mode, If needed, UTRAN will indicate the transition back to the selection mode.

	TGL	TGD	TGP1	TGP2	PD
Pattern8	7	0	72	Not Used	M
Pattern9	7	0	144	Not Used	M

~~1.1.1.1.2~~7.1.3.2.2 Monitoring of TDD cells

<Editors note: This section should describes particular rules to set the compressed mode parameters when monitoring TDD cell, both for the downlink and uplink compressed mode depending on the handover monitoring set, as well as provide some descriptive text on the monitoring process itself.>

Upper layers may ask dual mode FDD/TDD UE to perform preparation of inter-frequency handover to TDD. In such case, the UTRAN signals to the UE the handover monitoring set, and if needed, the compressed mode parameters used to make the needed measurements. Setting of the compressed mode parameters defined in 7.1.2.2 for the preparation of handover from UTRA FDD to UTRA TDD is indicated in the following section. Measurements to be performed by the physical layer are defined in section 6.

7.1.3.2.2.1 Setting of the compressed mode parameters

When compressed mode is used for cell acquisition at each target TDD frequency, the parameters of compressed mode pattern are fixed to be:

TGL	TGD	TGP	PD

~~1.1.1.1.1.2~~7.1.3.2.2.2 Setting of compressed mode parameters with prior timing information between FDD serving cell and TDD target cells

UTRAN or UE may have some prior knowledge of the frame timing difference between some FDD cells in UEs active set and some TDD cells in the handover monitoring set. When this information is acquired by the UE (e.g. after initial SCH detection) and on upper layers command, the UE shall report it to the upper layers for verification of UTRANs information, and feedback of this information from UTRAN to the other UE.

In this case with prior timing information the compressed mode parameters in chapter 7.1.2.2. are set in a way that takes into account the frame timing difference and the slot number of the PCCPCH in the target TDD cell. The position of the transmission gap allows directly the monitoring of the TDD cells timeslot that contains the PCCPCH.

~~1.1.1.1.3~~7.1.3.2.3 Monitoring of GSM cells

Upper layers may ask dual mode FDD/GSM UE to perform preparation of inter-frequency handover to GSM. In such case, the UTRAN signals to the UE the handover monitoring set, and if needed, the compressed mode parameters used to make the needed measurements.

The UE shall perform measurements so as to be able to report every [x msec] to the UTRAN the BSIC and the signal strength of up to [y] GSM cells in the handover monitoring set.

The involved measurements are GSM BCCH power measurements (Section 7.1.3.2.3.1~~7.1.3.3.6.3~~), initial GSM SCH or FCCH acquisition (Section 7.1.3.2.3.2~~7.1.3.3.6.4~~), acquisition/tracking of GSM SCH or FCCH when timing information between UTRA serving cells and the target GSM cell is available (Section 7.1.3.2.3.3~~7.1.3.3.6.5~~), and BSIC reconfirmation (Section 7.1.3.2.3.4~~7.1.3.3.6.6~~).

<Editor's note : requirements for the monitoring are for descriptive purposes to illustrate how to set the compressed mode parameters. Such requirements should be found in the WG4 documentation>

~~1.1.1.1.1.1~~7.1.3.2.3.1 Setting of compressed mode parameters for Power measurements

When compressed mode is used for GSM BCCH power measurements, the parameters of compressed mode pattern are fixed to be :

Pattern No.	TGL	TGD	TGP	PD
1	3	0	8	128
2	tbd	tbd	tbd	tbd
3	tbd	tbd	tbd	tbd
4	tbd	tbd	tbd	tbd

Pattern 1 allows measuring all the adjacent cell signal levels even with the maximum of 32 frequencies, if two measurements are done during each transmission gap. The pattern can be repeated by sending the measurement request again, if more measurement data is desired.

< NOTE: Further compressed mode patterns with more and/or longer gaps for making more measurements will be introduced soon. >

In order to fulfil the expected GSM power measurements requirement, the UE can get effective measurements samples during a time window of length Tmeas, equal to the transmission gap length reduced by an implementation margin of [2*500 µs + 200 µs], which includes the maximum allowed delay for a UEs synthesizer to switch from one FDD frequency to one GSM frequency and switch back to FDD frequency, plus some additional implementation margin.~~When compressed mode is used for GSM BCCH power measurements, the parameters of compressed mode pattern are fixed to be :~~

TGL	TGD	TGP	PD

~~In order to fulfill the expected GSM power measurements requirement, the UE can get effective measurements samples during a time window of length Tmeas, equal to the transmission gap length reduced by an implementation margin of [x], that includes the maximum allowed delay for a UE's synthetizer to switch from one FDD frequency to one GSM frequency and switch back to FDD frequency, plus some additional implementation margin.~~

~~1.1.1.1.1.2~~7.1.3.2.3.2 Setting of compressed mode parameters for first SCH decoding without prior knowledge of timing information

The setting of the compressed mode parameters 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.

On upper layers command, UE shall pre-synchronise to the each of GSM cells in the handover monitoring set and decode their BSIC. < *Note : the proper reference to GSM specs should be added here* >

When compressed mode is used to perform initial FCCH/SCH acquisition, the compressed mode pattern belongs to the list of patterns in table .

In order to fulfill the expected GSM SCH speed requirement, the UE can get effective measurements samples during a time window of length Tmeas, equal to the transmission gap length reduced by an implementation margin of [2*500 µs + 200 µs~~x~~], that includes the maximum allowed delay for a UE's synthesizer~~synthetizer~~ to switch from one FDD frequency to one GSM frequency and switch back to FDD frequency, plus some additional implementation margin.

	TGL	TGD	TGP	PD parallel search / serial search
Pattern 1	7	0	2	40/64
Pattern 2	7	0	3	39/63
Pattern 3	7	2	9	63/252
Pattern 4	7	3	12	99/123
Pattern 5	14	0	2	12/26
Pattern 6	14	2	6	24/48
Pattern 7	14	2	8	34/58
Pattern 8	14	2	12	60/84
Pattern 9	10	12	48	108/828
Pattern 10	10	0	48	240/1440

Table .- List of compressed mode patterns used for initial GSM FCCH/SCH acquisition without timing information

The pattern duration for the parallel search (time until a GSM FCCH or SCH burst is found) and for the serial search (time until a FCCH burst is found) is given.

The patterns 5 should mainly be used in such cases where the present signal level suddenly drops and very little time to execute the handover is available. Patterns 1 are significantly more optimal from the point of view of the transmission power control than the other ones, while patterns 5 consume less slots for the measurements on the average.

Patterns 1~~4~~ may use any pattern described in specification 25.212 chapter 4.4.3.1. Patterns 5~~1~~0 must use the double frame method.

The patterns 9 and 10 are optimised for least consumption of slots for the measurements on the average using the parallel search. The patterns 9 and 10 achieve about the same or half the speed of the synchronisation to GSM from GSM. They must use the double frame method, the compression can be achieved by changing the coding rate from 1/3 to 1/2.

Each pattern corresponds to a different compromise between speed of GSM SCH search and rate of use of compressed frames. On upper layers command, the repetition of the selected pattern can be stopped and/or replaced by one of the other listed patterns. Upper layers may also decide to alternate the use of different patterns periods.

Depending on the UEs 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 repeated patterns.

Once the UE has completed the search it signals the UTRAN with FCCH-found or SCH-found, both with the timing of the associated SCH burst, or with FCCH/SCH-not-found (see < *Editor's note : reference to be inserted here* >).

In case of FCCH-found, the UTRAN can continue the current pattern until also SCH is found or stop it and schedule a single, properly aligned gap for SCH search as described in 7.1.3.2.3.3~~7.1.3.3.6.4~~.~~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 *< Editor's note : reference to be inserted here >*).~~

Whenever UE receives a new neighbour cell with a sufficiently high power level (see < *Editor's note : reference to be inserted here* >), it shall perform a new SCH search procedure.

When a compressed mode pattern is available, then it is up to the UE to trigger this search procedure with the available transmission gaps. In this case, no specific signalling is needed between the UE and the UTRAN.

When a compressed mode pattern is not available, the UE shall initiate the search procedure by sending a "request new cell search" message to the UTRAN. Based on the UEs capabilities for serial or parallel search as described above, the UTRAN then determines a suitable compressed mode pattern and signals this to the UE. The upper layers can delay the onset of this pattern depending on the timing priority the Network Operator has set for new BSIC identification.

~~1.1.1.1.1.3~~7.1.3.2.3.3 Setting of compressed mode parameters for first SCH decoding with prior timing information between UTRAN serving cells and GSM target cells

UTRAN or UE may have some prior knowledge of timing difference between some FDD cells in UEs active set and some GSM cells in the handover monitoring set. When this information is acquired by the UE (e.g. after initial FCCH/SCH detection) and on upper layers command, the UE shall report it to the upper layers for verification of UTRANs information, and feedback of this information from UTRAN to the other UE.

When UTRAN or UE have this prior timing information, the compressed mode shall be scheduled by upper layers with the intention that SCH (or FCCH if needed) on a specific GSM band can be decoded at the UE during the transmission gap.

~~In such case, a transmission gap is scheduled once 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 transmission gap parameters used for GSM FCCH/SCH tracking with prior timing information are :

TGL	SFN	SN
4	(calculated by UTRAN)	(calculated by UTRAN)

TGL	SFN	SN

In addition to normal compressed mode parameters, UTRAN signals the following information to the UE :

~~• The frame number where compressed mode occurs (frame number x+n times 306, where n=0,1,2,3)~~

• The GSM carrier for which the particular compressed frame is intended (BS ID, carrier no, etc.)

Once the UE has completed the search, it signals the UTRAN with the timing of the associated SCH burst or with SCH-not-found ~~and the UTRAN ceases the compressed mode pattern~~.

~~1.1.1.1.4~~7.1.3.2.3.4 Setting of compressed mode 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.

When a compressed mode pattern is available, then it is up to the UE to trigger and perform the BSIC reconfirmation procedure with the available transmission gaps. In this case, no specific signalling is needed between the UE and the UTRAN for BSIC reconfirmation procedure.

When no compressed mode pattern is available then it is up to the UE to trigger and perform the BSIC reconfirmation procedure. In that case, UE indicates to the upper layers the schedule of the SCH burst of that cell, and the size of the necessary transmission gap necessary to capture one SCH burst. The Network Operator decides the target time for BSIC reconfirmation and the upper layers uses this and the schedule indicated by the UE to determine the appropriate compressed mode parameters.

The compressed mode parameters shall be one of those described in section 7.1.3.2.3.3~~3.6.4.~~ ~~Depending on whether UTRAN has an a priori timing knowledge of neighbouring GSM cells, the compressed mode parameters shall be one of those described in section 7.1.3.3.6.3, or in section 7.1.3.3.6.4.~~

~~1.1.1.1.5~~7.1.3.2.3.5 Parametrisation of the compressed mode for handover preparation to GSM

Whereas section 7.1.3.2.3.2~~7.1.3.3.6.3~~ described the compressed mode parametrisation for the initial synchronisation tracking or reconfirmation for one cell and the compressed mode parameters for power measurement for one of multiple cells, there is a need to define the global compressed mode parameters when considering the monitoring of all GSM cells.

<Editor's note : the overall description for the handover to GSM preparation is still missing>

~~1.1.1.3~~7.1.3.3 Overall handover preparation at the UE

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 at the UE. Whereas Section 7.1.3.2.1~~7.1.3.3.4~~, 7.1.3.2.2~~7.1.3.3.5~~, and 7.1.3.2.3~~7.1.3.3.6~~ 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.

~~1.2~~7.2 UTRAN measurements

8 Removal of paragraphs from the original TS 25.231 v0.3.1

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

Paragraph	**Comment**
5.1	Heading 5.1 replaced by heading 5.1.1 in this new structure. Some of the editor text between section 5.1 to 5.1.1 removed.
5.1.1	Moved to 7.1.1.1, minor editorial changes (e.g. to wrong references).
5.1.2	Measurement abilities defined in section 6.
5.2	Heading 5.2 replaced by heading 7.1.1 in this new structure.
5.2.1	Moved to 7.1.1.1, minor editorial changes (e.g. to wrong references).
5.2.2	Measurement abilities defined in section 6.
6	Measurements at call set-up, DCA measurements, TDD only, removed.
7.1	Heading 7.1 replaced by heading 7.1.1.2 in this new structure.
7.1.2	Removed. Not a WG1 issue.
7.1.3	Heading removed.
7.1.3.1	Removed, empty section.
7.1.3.2	Partly removed, this section also contained what to measure for handover, the measurements are now described in section 6.
7.1.3.3	Heading 7.1.3.3 replaced by heading 7.1.3 in this new structure.
7.1.3.3.1	Moved into section Compressed mode, 7.1.2
7.1.3.3.2	Moved into section Compressed mode, 7.1.2
7.1.3.3.3	Measurement requirements handled by WG4.
7.1.3.3.4.2	Measurement abilities defined in section 6.
7.1.3.3.5.2	Measurement abilities defined in section 6.
7.1.4	Mesurements for the Handover preparation in FDD at the UTRAN side (empty section), removed, measurement quantities handled in section 6.
7.1.5	TDD section
7.1.6	TDD section
7.1.7	TDD section
7.2	Measurement for cell reselection in active mode', section not needed, editor's note deleted, 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	TDD section

Paragraph	Comment
7.5	Measurements on adjacent channels, removed, not needed?
7.6	Measurements for radio-link time-out (or sync loss) deleted.
8	Radio Link Measurement section not needed. Measurement quantities are defined in section 6 instead.
Annex 1	Handover scenarios. Completely removed, not an WG1 issue.
Annex 2	Handover execution. Completely removed.

9 History

V0.0.1	02.09.1999	First version of "TS 25.215 Physical Layer – Measurements (FDD)" based on "TS 25.231 Physical Layer – Measurements" V0.3.1 of 11.08.1999 approved in RAN WG1#6.
The editor for TS 25.215 Physical Layer – Measurements (FDD) is: Xy Xy Phone: , fax: , email: This document is written in Microsoft Word 97.		