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Foreword

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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

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1 Scope

The present document contains the description and definition of the measurements done at the UE and network in TDD mode in order to support operation in idle mode and connected mode.

2 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, the latest version applies.

[1] 3G TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)".

[2] 3G TS 25.212: "Multiplexing and channel coding (FDD)".

[3] 3G TS 25.213: "Spreading and modulation (FDD)".

[4] 3G TS 25.214: "Physical layer procedures (FDD)".

[5] 3G TS 25.215: "Physical layer measurements (FDD)".

[6] 3G TS 25.221: "Physical channels and mapping of transport channels onto physical channels (TDD)".

[7] 3G TS 25.222: "Multiplexing and channel coding (TDD)".

[8] 3G TS 25.223: "Spreading and modulation (TDD)".

[9] 3G TS 25.224: "Physical layer procedures (TDD)".

[10] 3G TS 25.301: "Radio Interface Protocol Architecture".

[11] 3G TS 25.302: "Services provided by the Physical layer".

[12] 3G TS 25.303: "UE functions and interlayer procedures in connected mode".

[13] 3G TS 25.304: "UE procedures in idle mode".

[14] 3G TS 25.331: "RRC Protocol Specification".

[15] 3G TR 25.922: "Radio Resource Management Strategies".

[16] 3G TR 25.923: "Report on Location Services (LCS)".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BER	Bit Error Rate
BLER	Block Error Rate
DCH	Dedicated Channel
DPCH	Dedicated Physical Channel
Ec/No	Received energy per chip divided by the power density in the band

FACH	Forward Access Channel
ISCP	Interference Signal Code Power
P-CCPCH	Primary Common Control Physical Channel
PCH	Paging Channel
PRACH	Physical Random Access Channel
RACH	Random Access Channel
RSCP	Received Signal Code Power
RSSI	Received Signal Strength Indicator
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronisation Channel
SIR	Signal-to-Interference Ratio
UE	User Equipment

4 Control of UE/UTRAN measurements

In this clause the general measurement control concept of the higher layers is briefly described to provide an understanding on how L1 measurements are initiated and controlled by higher layers.

4.1 General measurement concept

L1 provides with the measurement specifications a toolbox of measurement abilities for the UE and the UTRAN. These measurements can be differentiated in different measurement types: intra-frequency, inter-frequency, inter-system, traffic volume, quality and internal measurements (see [14]).
In the L1 measurement specifications the measurements are distinguished between measurements in the UE (the messages will be described in the RRC Protocol) and measurements in the UTRAN (the messages will be described in the NBAP and the Frame Protocol).

To initiate a specific measurement the UTRAN transmits a 'measurement control message' to the UE including a measurement ID and type, a command (setup, modify, release), the measurement objects and quantity, the reporting quantities, criteria (periodical/event-triggered) and mode (acknowledged/unacknowledged), see [14].
When the reporting criteria is fulfilled the UE shall answer with a 'measurement report message' to the UTRAN including the measurement ID and the results.
In idle mode the measurement control message is broadcast in a System Information.

Intra-frequency reporting events, traffic volume reporting events and UE internal measurement reporting events described in [14] define events which trigger the UE to send a report to the UTRAN. This defines a toolbox from which the UTRAN can choose the needed reporting events.

4.2 Measurements for cell selection/reselection

Whenever a PLMN has been selected the UE shall start to find a suitable cell to camp on, this is 'cell selection'.
When camped on cell the UE regularly searches for a better cell depending on the cell reselection criteria, this is called 'cell reselection'. The procedures for cell selection and reselection are described in [13] and the measurements carried out by the UE are explained in this specification.

4.3 Measurements for Handover

For the handover preparation the UE receives from the UTRAN a list of cells (e.g. TDD, FDD or GSM).which the UE shall monitor (see 'monitored set' in [14]) in its idle timeslots.

At the beginning of the measurement process the UE shall find synchronization to the cell to measure using the synchronization channel. This is described under 'cell search' in [9] if the monitored cell is a TDD cell and in [4] if it is an FDD cell.

For a TDD cell to monitor after this procedure the exact timing of the midamble of the P-CCPCH 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 P-CCPCH directly without prior SCH synchronisation.

4.4 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.

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 signalling and measurement reporting.

In connected mode the UE performs measurements according to a measurement control message from the UTRAN.

4.5 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.

5 Measurement abilities for UTRA TDD

In this clause the physical layer measurements reported to higher layers. (this may also include UE internal measurements not reported over the air-interface) are defined.

5.1 UE measurement abilities

NOTE 1: Measurements for TDD which are specified on the Primary CCPCH (P-CCPCH) are carried out on the P-CCPCH or other physical channels with beacon function, see [6].

NOTE 2: For those channels providing beacon function [6], the received power measurements are based on the sum of the received powers for midambles $m^{(1)}$ and $m^{(2)}$.

NOTE 3: The UTRAN has to take into account the UE capabilities when specifying the timeslots to be measured in the measurement control message.

NOTE 4: The RSCP can either be measured on the data part or the midamble of a burst, since there is no power offset between both. However, in order to have a common reference, the measurement on the midamble is assumed.

NOTE 5: The line 'applicable for' indicates whether the measurement is applicable for inter-frequency and/or intra-frequency and furthermore for idle and/or connected mode.

5.1.1 P-CCPCH RSCP

Definition	Received Signal Code Power, the received power on P-CCPCH of own or neighbour cell. The reference point for the RSCP is the antenna connector at the UE.
Applicable for	idle mode, connected mode (intra-frequency & inter-frequency)
Range/mapping	P-CCPCH RSCP is given with a resolution of 1 dB with the range [-115, ..., -25] dBm. P-CCPCH RSCP shall be reported in the unit P-CCPCH_RSCP_LEV where: P-CCPCH_RSCP_LEV_00: P-CCPCH_RSCP < -115dBm P-CCPCH_RSCP_LEV_01: -115dBm ≤ P-CCPCH_RSCP < -114dBm P-CCPCH_RSCP_LEV_02: -114dBm ≤ P-CCPCH_RSCP < -113dBm ... P-CCPCH_RSCP_LEV_89: -27dBm ≤ P-CCPCH_RSCP < -26dBm P-CCPCH_RSCP_LEV_90: -26dBm ≤ P-CCPCH_RSCP < -25dBm P-CCPCH_RSCP_LEV_91: -25dBm ≤ P-CCPCH_RSCP

5.1.2 CPICH RSCP

Definition	Received Signal Code Power, the received power on one code measured on the Primary CPICH. The reference point for the RSCP is the antenna connector at the UE. (This measurement is used in TDD for monitoring FDD cells while camping on a TDD cell). If Tx diversity is applied on the Primary CPICH the received code power from each antenna shall be separately measured and summed together in [W] to a total received code power on the Primary CPICH.
Applicable for	idle mode, connected mode (inter-frequency)
Range/mapping	CPICH RSCP is given with a resolution of 1 dB with the range [-115, ..., -25] dBm. CPICH RSCP shall be reported in the unit CPICH_RSCP_LEV where: CPICH_RSCP_LEV_00: CPICH_RSCP < -115dBm CPICH_RSCP_LEV_01: -115dBm ≤ CPICH_RSCP < -114dBm CPICH_RSCP_LEV_02: -114dBm ≤ CPICH_RSCP < -113dBm ... CPICH_RSCP_LEV_89: -27dBm ≤ CPICH_RSCP < -26dBm CPICH_RSCP_LEV_90: -26dBm ≤ CPICH_RSCP < -25dBm CPICH_RSCP_LEV_91: -25dBm ≤ CPICH_RSCP

5.1.3 Timeslot ISCP

Definition	Interference Signal Code Power, the interference on the received signal in a specified timeslot. Only this part of the interference that is not eliminated by the receiver shall be included in the measurement. The reference point for the ISCP is the antenna connector at the UE.
Applicable for	connected mode (intra-frequency).
Range/mapping	Timeslot ISCP is given with a resolution of 1 dB with the range [-115, ..., -25] dBm. Timeslot ISCP shall be reported in the unit UE_TS_ISCP_LEV where: UE_TS_ISCP_LEV_00: Timeslot_ISCP < -115dBm UE_TS_ISCP_LEV_01: -115dBm ≤ Timeslot_ISCP < -114dBm UE_TS_ISCP_LEV_02: -114dBm ≤ Timeslot_ISCP < -113dBm ... UE_TS_ISCP_LEV_89: -27dBm ≤ Timeslot_ISCP < -26dBm UE_TS_ISCP_LEV_90: -26dBm ≤ Timeslot_ISCP < -25dBm UE_TS_ISCP_LEV_91: -25dBm ≤ Timeslot_ISCP

5.1.4 UTRA carrier RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth in a specified timeslot. Measurement shall be performed on a UTRAN DL carrier. The reference point for the RSSI is the antenna connector at the UE.
Applicable for	idle mode, connected mode (intra- & inter-frequency)
Range/mapping	UTRA carrier RSSI is given with a resolution of 1 dB with the range [-94, ..., -32] dBm. UTRA carrier RSSI shall be reported in the unit UTRA_carrier_RSSI_LEV where: UTRA_carrier_RSSI_LEV_00: UTRA_carrier_RSSI < -94dBm UTRA_carrier_RSSI_LEV_01: -94dBm ≤ UTRA_carrier_RSSI < -93dBm UTRA_carrier_RSSI_LEV_02: -93dBm ≤ UTRA_carrier_RSSI < -92dBm ... UTRA_carrier_RSSI_LEV_61: -34dBm ≤ UTRA_carrier_RSSI < -33dBm UTRA_carrier_RSSI_LEV_62: -33dBm ≤ UTRA_carrier_RSSI < -32dBm UTRA_carrier_RSSI_LEV_63: -32dBm ≤ UTRA_carrier_RSSI

5.1.5 GSM carrier RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth in a specified timeslot. Measurement shall be performed on a GSM BCCH carrier. The reference point for the RSSI is the antenna connector at the UE.
Applicable for	idle mode, connected mode (inter-frequency)
Range/mapping	According to the definition of RXLEV in GSM 05.08.

5.1.6 SIR

Definition	Signal to Interference Ratio, defined as: (RSCP/ISCP)xSF. Where: RSCP = Received Signal Code Power, the received power on the code of a specified DPCH or PDSCH. ISCP = Interference Signal Code Power, the interference on the received signal in the same timeslot which can't be eliminated by the receiver. SF = The used spreading factor. The reference point for the SIR is the antenna connector of the UE.
Applicable for	connected mode (intra-frequency)
Range/mapping	SIR is given with a resolution of 0.5 dB with the range [-11, ..., 20] dB. SIR shall be reported in the unit UE_SIR where: UE_SIR_00: SIR < -11.0dB UE_SIR_01: -11.0dB ≤ SIR < -10.5dB UE_SIR_02: -10.5dB ≤ SIR < -10.0dB .... UE_SIR_61: 19.0dB ≤ SIR < 19.5dB UE_SIR_62: 19.5dB ≤ SIR < 20.0dB UE_SIR_63: 20.0dB ≤ SIR

5.1.7 CPICH Ec/No

Definition	The received energy per chip divided by the power density in the band. The Ec/No is identical to RSCP/RSSI. Measurement shall be performed on the Primary CPICH. The reference point for Ec/No is the antenna connector at the UE. (This measurement is used in TDD for monitoring FDD cells while camping on a TDD cell) If Tx diversity is applied on the Primary CPICH the received energy per chip (Ec) from each antenna shall be separately measured and summed together in [Ws] to a total received chip energy per chip on the Primary CPICH, before calculating the Ec/No.
Applicable for	idle mode, connected mode (inter-frequency)
Range/mapping	CPICH Ec/No is given with a resolution of 1 dB with the range [-24, ..., 0] dB. CPICH Ec/No shall be reported in the unit CPICH_Ec/No where: CPICH_Ec/No_00: CPICH_Ec/No < -24dB CPICH_Ec/No_01: -24dB ≤ CPICH_Ec/No < -23dB CPICH_Ec/No_02: -23dB ≤ CPICH_Ec/No < -22dB ... CPICH_Ec/No_23: -2dB ≤ CPICH_Ec/No < -1dB CPICH_Ec/No_24: -1dB ≤ CPICH_Ec/No < 0dB CPICH_Ec/No_25: 0dB ≤ CPICH_ Ec/No

5.1.8 Transport channel 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.
Applicable for	connected mode (intra-frequency)
Range/mapping	Transport channel BLER is given with a logarithmic resolution of 0.065 with the range [10^-4.03 ... 1] including a separate case Transport channel BLER=0. Transport channel BLER shall be reported in the unit BLER_LOG, where: BLER_LOG_00: BLER = 0 BLER_LOG_01: -∞ < Log10(Transport channel BLER) < -4.030 BLER_LOG_02: -4.030 ≤ Log10(Transport channel BLER) < -3.965 BLER_LOG_03: -3.965 ≤ Log10(Transport channel BLER) < -3.900 ... BLER_LOG_61: -0.195 ≤ Log10(Transport channel BLER) < -0.130 BLER_LOG_62: -0.130 ≤ Log10(Transport channel BLER) < -0.065 BLER_LOG_63: -0.065 ≤ Log10(Transport channel BLER) ≤ 0.000

5.1.9 UE transmitted power

Definition	The total UE transmitted power on one carrier measured in a timeslot. The reference point for the UE transmitted power shall be the UE antenna connector.
Applicable for	connected mode (intra-frequency).
Range/mapping	UE transmitted power is given with a resolution of 1dB with the range [-50, ..., 33] dBm. UE transmitted power shall be reported in the unit UE_TX_POWER, where: UE_TX_POWER_000 to UE_TX_POWER_020: reserved UE_TX_POWER_021: -50dBm ≤ UE_transmitted_power < -49dBm UE_TX_POWER_022: -49dBm ≤ UE_transmitted_power < -48dBm UE_TX_POWER_023: -48dBm ≤ UE_transmitted_power < -47dBm ... UE_TX_POWER_102: 31dBm ≤ UE_transmitted_power < 32dBm UE_TX_POWER_103: 32dBm ≤ UE_transmitted_power < 33dBm UE_TX_POWER_104: 33dBm ≤ UE_transmitted_power < 34dBm

5.1.10 SFN-SFN observed time difference

Definition	SFN-SFN observed time difference is the time difference of the reception times of frames from two cells (serving and target) measured in the UE and expressed in chips. It is distinguished in two types. Type 2 applies if the serving and the target cell have the same frame timing. **Type 1:** SFN-SFN observed time difference = OFF×38400+ T_m in chips, where: $T_m = T_{RxSFNi} - T_{RxSFNk}$, given in chip units with the range [0, 1, …, 38399] chips T_{RxSFNi} : time of start of the received frame SFN_i of the serving TDD cell i. T_{RxSFNk} : time of start of the received frame SFN_k of the target UTRA cell k received most recent in time before the time instant T_{RxSFNi} in the UE. If this frame SFN_k of the target UTRA cell is received exactly at T_{RxSFNi} then $T_{RxSFNk} = T_{RxSFNi}$ (which leads to T_m=0). OFF=(SFN_i- SFN_k) mod 256, given in number of frames with the range [0, 1, …, 255] frames SFNi : system frame number for downlink frame from serving TDD cell i in the UE at the time T_{RxSFNi}. SFNk : system frame number for downlink frame from target UTRA cell k received in the UE at the time T_{RxSFNk}.(for FDD: the P-CCPCH frame) **Type 2:** SFN-SFN observed time difference = $T_{RxTSk} - T_{RxTSi}$, in chips, where T_{RxTSi} : time of start of a timeslot received of the serving TDD cell i. T_{RxTSk} : time of start of a timeslot received from the target UTRA cell k that is closest in time to the start of the timeslot of the serving TDD cell i.
Applicable for	idle mode, connected mode (intra-frequency), connected mode (inter-frequency)
Range/mapping	**Type 1:** SFN-SFN observed time difference is given with a resolution of 1 chip with the range [0; 9830400) chips (24 bits). SFN-SFN observed time difference shall be reported in the unit T1_SFN-SFN_TIME, where T1_SFN-SFN_TIME_N: N* 1 chip ≤ SFN-SFN observed time difference < (N+1)* 1 chip With N= 0, 1, 2, ..., 9830399 **Type 2:** SFN-SFN observed time difference is given with a resolution of 0.25 chip with the range (-1280; 1280] chips (14 bits). SFN-SFN observed time difference shall be reported in the unit T2_SFN-SFN_TIME, where T2_SFN-SFN_TIME_N: N* 0.25 chip –1280 chips < SFN-SFN observed time difference ≤ (N+1)* 0.25 chip –1280 chips With N= 0, 1, 2, ..., 10239

5.1.11 Observed time difference to GSM cell

Definition	Observed time difference to GSM cell is the time difference T_m in ms, where $T_m = T_{RxGSMk} - T_{RxSFN0i}$ $T_{RxSFN0i}$: time of start of the received frame SFN=0 of the serving TDD cell i $T_{RxGSMk.}$: time of start of the GSM BCCH 51-multiframe of the considered target GSM frequency k received closest in time after the time $T_{RxSFN0i.}$ If the next GSM BCCH 51-multiframe is received exactly at $T_{RxSFN0i}$ then $T_{RxGSMk} = T_{RxSFN0i}$ (which leads to T_m=0). The beginning of the GSM BCCH 51-multiframe is defined as the beginning of the first tail bit of the frequency correction burst in the first TDMA-frame of the GSM BCCH 51-multiframe, i.e. the TDMA-frame following the IDLE-frame.
Applicable for	Idle mode, connected mode (inter-frequency)
Range/mapping	Observed time difference to GSM cell is given with a resolution of 3060ms/(13*4096) (12 bit) with the range [0, 3060/13) ms. Observed time difference to GSM cell shall be reported in the unit GSM_TIME, where GSM_TIME_N: N* 3060ms/(13*4096) ≤ Observed time difference to GSM cell < (N+1)* 3060ms/(13*4096) With N= 0, 1, 2, ..., 4095

5.2 UTRAN measurement abilities

NOTE 1: If the UTRAN supports multiple frequency bands then the measurements apply for each frequency band individually.

NOTE 2: The RSCP can either be measured on the data part or the midamble of a burst, since there is no power offset between both. However, in order to have a common reference, the measurement on the midamble is assumed.

5.2.1 RSCP

Definition	Received Signal Code Power, the received power on one DPCH, PRACH or PUSCH code. The reference point for the RSCP shall be the antenna connector.
Range/mapping	RSCP is given with a resolution of 0.5 dB with the range [-120, ..., -80] dBm. RSCP shall be reported in the unit RSCP_LEV where: RSCP_LEV_00: RSCP < -120.0dBm RSCP_LEV_01: -120.0dBm ≤ RSCP < -119.5dBm RSCP_LEV_02: -119.5dBm ≤ RSCP < -119.0dBm ... RSCP_LEV_79: -81.0dBm ≤ RSCP < -80.5dBm RSCP_LEV_80: -80.5dBm ≤ RSCP < -80.0dBm RSCP_LEV_81: -80.0dBm ≤ RSCP

5.2.2 Timeslot ISCP

Definition	Interference Signal Code Power, the interference on the received signal in a specified timeslot. Only this part of the interference that is not eliminated by the receiver shall be included in the measurement. The reference point for the ISCP shall be the antenna connector.
Range/mapping	Timeslot ISCP is given with a resolution of 0.5 dB with the range [-120, ..., -80] dBm. Timeslot ISCP shall be reported in the unit UTRAN_TS_ISCP_LEV where: UTRAN_TS_ISCP_LEV_00: Timeslot_ISCP < -120.0dBm UTRAN_TS_ISCP_LEV_01: -120.0dBm ≤ Timeslot_ISCP < -119.5dBm UTRAN_TS_ISCP_LEV_02: -119.5dBm ≤ Timeslot_ISCP < -119.0dBm ... UTRAN_TS_ISCP_LEV_79: -81.0dBm ≤ Timeslot_ISCP < -80.5dBm UTRAN_TS_ISCP_LEV_80: -80.5dBm ≤ Timeslot_ISCP < -80.0dBm UTRAN_TS_ISCP_LEV_81: -80.0dBm ≤ Timeslot_ISCP

5.2.3 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the UTRAN UL carrier channel bandwidth in a specified timeslot. The reference point for the RSSI shall be the antenna connector.
Range/mapping	RSSI is given with a resolution of 0.1dB with the range [-112, ..., -50] dBm. RSSI shall be reported in the unit RSSI_LEV, where: RSSI_LEV_000: RSSI < -112.0dBm RSSI_LEV_001: -112.0dBm ≤ RSSI < –111.9dBm RSSI_LEV_002: -111.9dBm ≤ RSSI < –111.8dBm ... RSSI_LEV_619: -50.2dBm ≤ RSSI < –50.1dBm RSSI_LEV_620: -50.1dBm ≤ RSSI < –50.0dBm RSSI_LEV_621: -50.0dBm ≤ RSSI

5.2.4 SIR

Definition	Signal to Interference Ratio, defined as: (RSCP/ISCP)xSF. Where: RSCP = Received Signal Code Power, the received power on the code of a specified DPCH, PRACH or PUSCH. ISCP = Interference Signal Code Power, the interference on the received signal in the same timeslot which can't be eliminated by the receiver. SF = The used spreading factor. The reference point for the SIR shall be the antenna connector.
Range/mapping	SIR is given with a resolution of 0.5 dB with the range [-11, ..., 20] dB. SIR shall be reported in the unit UTRAN_SIR where: UTRAN_SIR_00: SIR < -11.0dB UTRAN_SIR_01: -11.0dB ≤ SIR < -10.5dB UTRAN_SIR_02: -10.5dB ≤ SIR < -10.0dB .... UTRAN_SIR_61: 19.0dB ≤ SIR < 19.5dB UTRAN_SIR_62: 19.5dB ≤ SIR < 20.0dB UTRAN_SIR_63: 20.0dB ≤ SIR

5.2.5 Transport channel BER

Definition	The transport channel BER is an estimation of the average bit error rate (BER) of DCH or USCH data. The transport channel (TrCH) BER is measured from the data considering only non-punctured bits at the input of the channel decoder in Node B. It shall be possible to report an estimate of the transport channel BER for a TrCH after the end of each TTI of the TrCH. The reported TrCH BER shall be an estimate of the BER during the latest TTI for that TrCH. Transport channel BER is only required to be reported for TrCHs that are channel coded.
Range/mapping	Transport channel BER is given with a logarithmic resolution of 0.008125 within the range [10^-2.06375 ... 1] with two separate cases Transport channel BER=0 and Transport channel BER between 0 and 10^-2.06375.. Transport channel BER shall be reported in the unit TrCH_BER_LOG, where: TrCH_BER_LOG_000: Transport channel BER = 0 TrCH_BER_LOG_001: -∞ < Log10(Transport channel BER) < -2.06375 TrCH_BER_LOG_002: -2.06375 ≤ Log10(Transport channel BER) < -2.055625 TrCH_BER_LOG_003: -2.055625 ≤ Log10(Transport channel BER) < -2.0475 ... TrCH_BER_LOG_253: -0.024375 ≤ Log10(Transport channel BER) < -0.01625 TrCH_BER_LOG_254: -0.01625 ≤ Log10(Transport channel BER) < -0.008125 TrCH_BER_LOG_255: -0.008125 ≤ Log10(Transport channel BER) ≤ 0.000

5.2.6 Physical channel BER

Definition	The physical channel BER is an estimation of the average bit error rate (BER) of a DPCH or PUSCH.
Range/mapping	Physical channel BER is given with a logarithmic resolution of 0.008125 within the range [10^-2.06375 ... 1] with two separate cases Physical channel BER=0 and Physical channel BER between 0 and 10^-2.06375.. Physical channel BER shall be reported in the unit BER_LOG, where: BER_LOG_000: Physical channel BER = 0 BER_LOG_001: -∞ < Log10(Physical channel BER) < -2.06375 BER_LOG_002: -2.06375 ≤ Log10(Physical channel BER) < -2.055625 BER_LOG_003: -2.055625 ≤ Log10(Physical channel BER) < -2.0475 ... BER_LOG_253: -0.024375 ≤ Log10(Physical channel BER) < -0.01625 BER_LOG_254: -0.01625 ≤ Log10(Physical channel BER) < -0.008125 BER_LOG_255: -0.008125 ≤ Log10(Physical channel BER) ≤ 0.000

5.2.7 Transport channel BLER

Definition	Estimation of the transport channel block error rate (BLER) of a DCH or USCH. The BLER estimation shall be based on evaluating the CRC on each transport block.
Range/mapping	Transport channel BLER is given with a logarithmic resolution of 0.065 with the range [10^-4.03 ... 1] including a separate case Transport channel BLER=0. Transport channel BLER shall be reported in the unit BLER_LOG, where: BLER_LOG_00: BLER = 0 BLER_LOG_01: -∞ < Log10(Transport channel BLER) < -4.030 BLER_LOG_02: -4.030 ≤ Log10(Transport channel BLER) < -3.965 BLER_LOG_03: -3.965 ≤ Log10(Transport channel BLER) < -3.900 ... BLER_LOG_61: -0.195 ≤ Log10(Transport channel BLER) < -0.130 BLER_LOG_62: -0.130 ≤ Log10(Transport channel BLER) < -0.065 BLER_LOG_63: -0.065 ≤ Log10(Transport channel BLER) ≤ 0.000

5.2.8 Transmitted carrier power

Definition	Transmitted carrier power, is the ratio between the total transmitted power on one DL carrier [W] from one UTRAN access point measured in a timeslot and the maximum transmission power [W] that is possible to use on the same carrier during the measurement period. The maximum transmission power is the configured maximum transmission power for the cell. The measurement shall be possible on any carrier transmitted from the UTRAN access point. The reference point for the transmitted carrier power measurement shall be the antenna connector. In case of Tx diversity the transmitted carrier power for each branch shall be measured.
Range/mapping	Transmitted carrier power is given with a resolution of 1% with the range [0, ..., 100] %. Transmitted carrier power shall be reported in the unit UTRAN_TX_POWER, where: UTRAN_TX_POWER_000: Transmitted carrier power = 0% UTRAN_TX_POWER_001: 0% < Transmitted carrier power ≤ 1% UTRAN_TX_POWER_002: 1% < Transmitted carrier power ≤ 2% UTRAN_TX_POWER_003: 2% < Transmitted carrier power ≤ 3% ... UTRAN_TX_POWER_098: 97% < Transmitted carrier power ≤ 98% UTRAN_TX_POWER_099: 98% < Transmitted carrier power ≤ 99% UTRAN_TX_POWER_100: 99% < Transmitted carrier power ≤ 100%

5.2.9 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.
Range/mapping	Transmitted code power is given with a resolution of 0.5dB with the range [-10, ..., 46] dBm. Transmitted code power shall be reported in the unit UTRAN_TX_CODE_POWER, where: UTRAN_TX_CODE_POWER_000 to UTRAN_TX_POWER_009: reserved UTRAN_TX_ CODE_POWER_010: -10.0dBm ≤ CODE_POWER < -9.5dBm UTRAN_TX_ CODE_POWER_011: -9.5dBm ≤ CODE_POWER < -8.5dBm UTRAN_TX_ CODE_POWER_012: -8.5dBm ≤ CODE_POWER < -7.5dBm ... UTRAN_TX_ CODE_POWER_120: 45.0dBm ≤ CODE_POWER < 45.5dBm UTRAN_TX_ CODE_POWER_121: 45.5dBm ≤ CODE_POWER < 46.0dBm UTRAN_TX_ CODE_POWER_122: 46.0dBm ≤ CODE_POWER < 46.5dBm

5.2.10 RX Timing Deviation

Definition	'RX Timing Deviation' is the time difference $T_{RXdev} = T_{TS} – T_{RXpath}$ in chips, with T_{RXpath}: time of the reception in the Node B of the first significant uplink path to be used in the detection process T_{TS}: time of the beginning of the respective slot according to the Node B internal timing
Range/mapping	RX Timing Deviation is given with a resolution of 0.25 chip with the range [-256; 256) chips (11 bit). RX Timing Deviation cell shall be reported in the unit RX_TIME_DEV, where RX_TIME_DEV: (N* 0.25 –256) chips ≤ RX Timing Deviation < ((N+1)* 0.25 –256) chips With N= 0, 1, 2, ..., 2047

NOTE: This measurement can be used for timing advance calculation or location services.

Annex A (informative): Monitoring GSM from TDD: Calculation Results

A.1 Low data rate traffic using 1 uplink and 1 downlink slot

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.

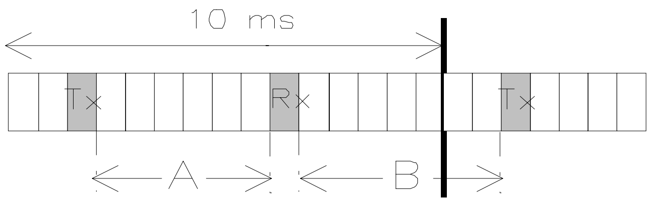

Figure A.1: Possible idle periods in a frame with two occupied timeslots

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.

Table A.1: example- of average and maximum synchronisation time with two busy timeslots per frame and with 0.8 ms switching time (*)

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

(*) 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.

A.1.1 Higher data rate traffic 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.

Table A.2: FCCH detection time for a dual synthesizer UE monitoring GSM from TDD every TDD frame

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	-	-

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:

Table A.3: Link between the synthesiser performance and the number of free consecutive TSs for guaranteed FCCH detection, needed for GSM monitoring

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

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
14/01/00	RAN_05	RP-99595	-		Approved at TSG RAN #5 and placed under Change Control	-	3.0.0
14/01/00	RAN_06	RP-99700	001	1	Primary and Secondary CCPCH in TDD	3.0.0	3.1.0
14/01/00	RAN_06	RP-99701	002	1	Block STTD capability for P-CCPCH, TDD component	3.0.0	3.1.0
14/01/00	RAN_06	RP-99700	003	1	Update concerning measurement definitions, ranges and mappings	3.0.0	3.1.0
14/01/00	-	-	-		Change history was added by the editor	3.1.0	3.1.1
31/03/00	RAN_07	RP-000071	004	1	Correction of CPICH measurements and 'RX Timing Deviation' range	3.1.1	3.2.0
31/03/00	RAN_07	RP-000071	005	2	Editorial modifications to 25.225	3.1.1	3.2.0
31/03/00	RAN_07	RP-000071	006	1	Corrections to 25.225 Measurements for TDD	3.1.1	

History

Document history		
V3.2.0	March 2000	Publication