ETSI TS 125 215 V3.2.0 (2000-03)

Technical Specification

Universal Mobile Telecommunications System (UMTS); Physical layer - Measurements (FDD) (3G TS 25.215 version 3.2.0 Release 1999)

Reference

RTS/TSGR-0125215UR1

Keywords

UMTS

ETSI

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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 for FDD done at the UE and network 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
Ec/No	Received energy per chip divided by the power density in the band
ISCP	Interference Signal Code Power
RL	Radio Link
RSCP	Received Signal Code Power
RSSI	Received Signal Strength Indicator
SIR	Signal to Interference Ratio

4 Control of UE/UTRAN measurements

In this chapter 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.

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, see chapter 5, 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.

5 Measurement abilities for UTRA FDD

In this chapter the physical layer measurements reported to higher layers (this may also include UE internal measurements not reported over the air-interface) are defined. The GSM measurements are required only from the GSM capable terminals. The TDD measurements are required only from the terminals that are capable to operate in TDD mode.

5.1 UE measurement abilities

The structure of the table defining a UE measurement quantity is shown below.

Column field	Comment
Definition	Contains the definition of the measurement.
Applicable for	States if a measurement shall be possible to perform in Idle mode and/or Connected mode. For connected mode also information of the possibility to perform the measurement on intra-frequency and/or inter-frequency are given. The following terms are used in the tables: Idle = Shall be possible to perform in idle mode; Connected Intra = Shall be possible to perform in connected mode on an intra-frequency; Connected Inter = Shall be possible to perform in connected mode on an inter-frequency.
Range/mapping	Gives the range and mapping to bits for the measurements quantity.

5.1.1 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. 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, Connected Intra, Connected Inter
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 < –115 dBm CPICH_RSCP_LEV _01: -115 dBm ≤ CPICH RSCP < –114 dBm CPICH_RSCP_LEV _02: -114 dBm ≤ CPICH RSCP < –113 dBm ... CPICH_RSCP_LEV _89: -27 dBm ≤ CPICH RSCP < -26 dBm CPICH_RSCP_LEV _90: -26 dBm ≤ CPICH RSCP < -25 dBm CPICH_RSCP_LEV _91: -25 dBm ≤ CPICH RSCP

5.1.2 PCCPCH RSCP

Definition	Received Signal Code Power, the received power on one code measured on the PCCPCH from a TDD cell. The reference point for the RSCP is the antenna connector at the UE. Note: The RSCP can either be measured on the data part or the midamble of a burst, since there is no power difference between these two parts. However, in order to have a common reference, measurement on the midamble is assumed.
Applicable for	Idle, Connected Inter
Range/mapping	PCCPCH RSCP is given with a resolution of 1 dB with the range [-115, ..., -25] dBm. PCCPCH RSCP shall be reported in the unit PCCPCH _RSCP_LEV where: PCCPCH _RSCP_LEV _00: PCCPCH RSCP < –115 dBm PCCPCH _RSCP_LEV _01: -115 dBm ≤ PCCPCH RSCP < –114 dBm PCCPCH _RSCP_LEV _02: -114 dBm ≤ PCCPCH RSCP < –113 dBm ... PCCPCH _RSCP_LEV _89: -27 dBm ≤ PCCPCH RSCP < -26 dBm PCCPCH _RSCP_LEV _90: -26 dBm ≤ PCCPCH RSCP < -25 dBm PCCPCH _RSCP_LEV _91: -25 dBm ≤ PCCPCH RSCP

5.1.3 SIR

Definition	Signal to Interference Ratio, defined as: (RSCP/ISCP)×(SF/2). The SIR shall be measured on DPCCH after RL combination. The reference point for the SIR is the antenna connector of the UE. where: RSCP = Received Signal Code Power, the received power on one code measured on the pilot bits. ISCP = Interference Signal Code Power, the interference on the received signal measured on the pilot bits. Only the non-orthogonal part of the interference is included in the measurement. SF=The spreading factor used.
Applicable for	Connected Intra
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 < –11.0 dB UE_SIR_01: -11.0 dB ≤ SIR < –10.5 dB UE_SIR_02: -10.5 dB ≤ SIR < –10.0 dB ... UE_SIR_61: 19.0 dB ≤ SIR < 19.5 dB UE_SIR_62: 19.5 dB ≤ SIR < 20.0 dB UE_SIR_63: 20.0 dB ≤ SIR

5.1.4 UTRA carrier RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth. Measurement shall be performed on a UTRAN downlink carrier. The reference point for the RSSI is the antenna connector at the UE.
Applicable for	Idle, Connected Intra, Connected Inter
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 < –94 dBm UTRA_carrier_RSSI_LEV _01: -94 dBm ≤ UTRA carrier RSSI < –93 dBm UTRA_carrier_RSSI_LEV _02: -93 dBm ≤ UTRA carrier RSSI < –92 dBm ... UTRA_carrier_RSSI_LEV _61: -34 dBm ≤ UTRA carrier RSSI < -33 dBm UTRA_carrier_RSSI_LEV _62: -33 dBm ≤ UTRA carrier RSSI < -32 dBm UTRA_carrier_RSSI_LEV _63: -32 dBm ≤ UTRA carrier RSSI

5.1.5 GSM carrier RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the relevant channel bandwidth. 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, Connected Inter
Range/mapping	According to the definition of RXLEV in GSM 05.08.

5.1.6 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. 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, Connected Intra, Connected Inter
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 < –24 dB CPICH_Ec/No _01: -24 dB ≤ CPICH Ec/No < –23 dB CPICH_Ec/No _02: -23 dB ≤ CPICH Ec/No < –22 dB ... CPICH_Ec/No _23: -2 dB ≤ CPICH Ec/No < -1 dB CPICH_Ec/No _24: -1 dB ≤ CPICH Ec/No < 0 dB CPICH_Ec/No _25: 0 dB ≤ CPICH Ec/No

5.1.7 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 after RL combination. BLER estimation is only required for transport channels containing CRC. In connected mode the BLER shall be possible to measure on any transport channel. If requested in idle mode it shall be possible to measure the BLER on transport channel PCH.
Applicable for	Idle, Connected Intra
Range/mapping	The Transport channel BLER shall be reported for 0 ≤ Transport channel BLER ≤ 1 in the unit BLER_LOG where: BLER_LOG_00: Transport channel BLER = 0 BLER_LOG_01: -∞ < Log10(Transport channel BLER) < -4.03 BLER_LOG_02: -4.03 ≤ Log10(Transport channel BLER) < -3.965 BLER_LOG_03: -3.965 ≤ Log10(Transport channel BLER) < -3.9 ... BLER_LOG_61: -0.195 ≤ Log10(Transport channel BLER) < -0.13 BLER_LOG_62: -0.13 ≤ Log10(Transport channel BLER) < -0.065 BLER_LOG_63: -0.065 ≤ Log10(Transport channel BLER) ≤ 0

5.1.8 UE transmitted power

Definition	The total UE transmitted power on one carrier. The reference point for the UE transmitted power shall be the UE antenna connector.
Applicable for	Connected Intra
Range/mapping	UE transmitted power is given with a resolution of 1 dB with the range [-50, ..., 33] dBm. UE transmitted power shall be reported in the unit UE_TX_POWER where: UE_TX_POWER _021: -50 dBm ≤ UE transmitted power < –49 dBm UE_TX_POWER _022: -49 dBm ≤ UE transmitted power < –48 dBm UE_TX_POWER _023: -48 dBm ≤ UE transmitted power < –47 dBm ... UE_TX_POWER _102 31 dBm ≤ UE transmitted power < 32 dBm UE_TX_POWER _103: 32 dBm ≤ UE transmitted power < 33 dBm UE_TX_POWER _104: 33 dBm ≤ UE transmitted power < 34 dBm

5.1.9 SFN-CFN observed time difference

Definition	The SFN-CFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= (T_{UETx}-T_0) - T_{RxSFN}, given in chip units with the range [0, 1, …, 38399] chips T_{UETx} is the time when the UE transmits an uplink DPCCH/DPDCH frame. T_0 is defined in TS 25.211 subclause 7.1.3. T_{RxSFN} is the time at the beginning of the neighbouring P-CCPCH frame received most recent in time before the time instant T_{UETx}-T_0in the UE. If the beginning of the neighbouring P-CCPCH frame is received exactly at T_{UETx}-T_0 then T_{RxSFN}=T_{UETx}-T_0 (which leads to T_m=0). and OFF=(SFN-CFN_{Tx}) mod 256, given in number of frames with the range [0, 1, …, 255] frames CFN_{Tx} is the connection frame number for the UE transmission of an uplink DPCCH/DPDCH frame at the time T_{UETx}. SFN is the system frame number for the neighbouring P-CCPCH frame received in the UE at the time T_{RxSFN}. In case the inter-frequency measurement is done with compressed mode, the value for the parameter OFF is always reported to be 0. In case that the SFN measurement indicator indicates that the UE does not need to read cell SFN of the target neighbour cell, the value of the parameter OFF is always be set to 0.
NOTE: In Compressed mode it is not required to read cell SFN of the target neighbour cell.	
Applicable for	Connected Inter, Connected Intra
Range/mapping	Time difference is given with the resolution of one chip with the range [0, …, 9830399] chips. Time difference shall be reported in the unit SFN-CFN_TIME where: SFN-CFN_TIME_0000000: 0 chip ≤ Time difference < 1 chip SFN-CFN_TIME_0000001: 1 chip ≤ Time difference < 2 chip SFN-CFN_TIME_0000002: 2 chip ≤ Time difference < 3 chip ... SFN-CFN_TIME_9830397: 9830397 chip ≤ Time difference < 9830398 chip SFN-CFN_TIME_9830398: 9830398 chip ≤ Time difference < 9830399 chip SFN-CFN_TIME_9830399: 9830399 chip ≤ Time difference < 9830400 chip

5.1.10 SFN-SFN observed time difference

Definition	**Type 1:** The SFN-SFN observed time difference to cell is defined as: OFF×38400+ T_m, where: T_m= T_{RxSFNj} - T_{RxSFNi}, given in chip units with the range [0, 1, …, 38399] chips T_{RxSFNj} is the time at the beginning of a received neighbouring P-CCPCH frame from cell j. T_{RxSFNi} is time at the beginning of the neighbouring P-CCPCH frame from cell i received most recent in time before the time instant T_{RxSFNj} in the UE. If the next neighbouring P-CCPCH frame is received exactly at T_{RxSFNj} then T_{RxSFNj}= T_{RxSFNi} (which leads to T_m=0). and OFF=(SFN_i- SFN_j) mod 256, given in number of frames with the range [0, 1, …, 255] frames SFN_j is the system frame number for downlink P-CCPCH frame from cell j in the UE at the time T_{RxSFNj}. SFN_i is the system frame number for the P-CCPCH frame from cell i received in the UE at the time T_{RxSFNi}. **Type 2:** The relative timing difference between cell j and cell i, defined as $T_{CPICHRxj}$ - $T_{CPICHRxi}$, where: $T_{CPICHRxj}$ is the time when the UE receives one Primary CPICH slot from cell j $T_{CPICHRxi}$ is the time when the UE receives the Primary CPICH slot from cell i that is closest in time to the Primary CPICH slot received from cell j
Applicable for	**Type 1:** Idle, Connected Intra **Type 2:** Idle, Connected Intra, Connected Inter
Range/mapping	**Type 1:** Time difference is given with a resolution of one chip with the range [0, …, 9830399] chips. Time difference shall be reported in the unit T1_SFN-SFN_TIME where: T1_SFN-SFN_TIME_0000000: 0 chip ≤ Time difference < 1 chip T1_SFN-SFN_TIME_0000001: 1 chip ≤ Time difference < 2 chip T1_SFN-SFN_TIME_0000002: 2 chip ≤ Time difference < 3 chip ... T1_SFN-SFN_TIME_9830397: 9830397 chip ≤ Time difference < 9830398 chip T1_SFN-SFN_TIME_9830398: 9830398 chip ≤ Time difference < 9830399 chip T1_SFN-SFN_TIME_9830399: 9830399 chip ≤ Time difference < 9830400 chip **Type 2:** Time difference is given with a resolution of 0.25 chip with the range [-1279.75, …, 1280] chips. Time difference shall be reported in the unit T2_SFN-SFN_TIME where: T2_SFN-SFN_TIME_00000: -1279.75 chip < Time difference ≤ -1279.50 chip T2_SFN-SFN_TIME_00001: -1279.50 chip < Time difference ≤ -1279.25 chip T2_SFN-SFN_TIME_00002: -1279.25 chip < Time difference ≤ -1279.00 chip ... T2_SFN-SFN_TIME_10236: 1279.25 chip < Time difference ≤ 1279.50 chip T2_SFN-SFN_TIME_10237: 1279.50 chip < Time difference ≤ 1279.75 chip T2_SFN-SFN_TIME_10238: 1279.75 chip < Time difference ≤ 1280.00 chip

5.1.11 UE Rx-Tx time difference

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.
Applicable for	Connected Intra
Range/mapping	The UE Rx-Tx time difference is given with the resolution of 0.25 chip with the range [876, …, 1172] chips. The UE Rx-Tx Time difference shall be reported in the unit RX-TX_TIME where: RX-TX_TIME_0000: UE Rx-Tx Time difference < 876.00 chip RX-TX_TIME_0001: 876.00 chip ≤ UE Rx-Tx Time difference < 876.25 chip RX-TX_TIME_0002: 876.25 chip ≤ UE Rx-Tx Time difference < 876.50 chip RX-TX_TIME_0003: 876.50 chip ≤ UE Rx-Tx Time difference < 876.75 chip ... RX-TX_TIME_1182: 1171.25 chip ≤ UE Rx-Tx Time difference < 1171.50 chip RX-TX_TIME_1183: 1171.50 chip ≤ UE Rx-Tx Time difference < 1171.75 chip RX-TX_TIME_1184: 1171.75 chip ≤ UE Rx-Tx Time difference < 1172.00 chip RX-TX_TIME_1185: 1172.00 chip ≤ UE Rx-Tx Time difference

5.1.12 Observed time difference to GSM cell

Definition	The Observed time difference to GSM cell is defined as: T_{RxGSMj} - T_{RxSFNi}, where: T_{RxSFNi} is the time at the beginning of the P-CCPCH frame with SFN=0 from cell i. T_{RxGSMj} is the time at the beginning of the GSM BCCH 51-multiframe from GSM frequency j received closest in time after the time T_{RxSFNi}. If the next GSM multiframe is received exactly at T_{RxSFNi} then T_{RxGSMj} =T_{RxSFNi} (which leads to T_{RxGSMj} - T_{RxSFNi} = 0). The timing measurement shall reflect the timing situation when the most recent (in time) P-CCPCH with SFN=0 was received in the UE. 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, Connected Inter
Range/mapping	The Observed time difference to GSM cell is given with the resolution of 3060/(4096×13) ms with the range [0, …, 3060/13-3060/(4096×13)] ms. Observed time difference to GSM cell shall be reported in the unit GSM_TIME where: GSM_TIME_0000: 0 ms ≤ Observed time difference to GSM cell < 1×3060/(4096×13) ms GSM_TIME_0001: 1×3060/(4096×13) ms ≤ Observed time difference to GSM cell < 2×3060/(4096×13) ms GSM_TIME_0002: 2×3060/(4096×13) ms ≤ Observed time difference to GSM cell < 3×3060/(4096×13) ms ... GSM_TIME_4093: 4093×3060/(4096×13) ms ≤ Observed time difference to GSM cell < 4094×3060/(4096×13) ms GSM_TIME_4094: 4094×3060/(4096×13) ms ≤ Observed time difference to GSM cell < 4095×3060/(4096×13) ms GSM_TIME_4095: 4095×3060/(4096×13) ms ≤ Observed time difference to GSM cell < 3060/13 ms

5.1.13 UE GPS Timing of Cell Frames for LCS

Definition	The timing between cell j and GPS Time Of Week. $T_{UE-GPSj}$ is defined as the time of occurrence of a specified UTRAN event according to GPS time. The specified UTRAN event is the beginning of a particular frame (identified through its SFN) in the first significant multipath of the cell j CPICH, where cell j is a cell within the active set.
Applicable for	Connected Intra, Connected Inter
Range/mapping	The resolution of $T_{UE-GPSj}$ is 0.125 chips. The range is from 0 to 2319360000000 chips. $T_{UE-GPSj}$ shall be reported in the unit GPS_TIME where: GPS_TIME_00000000000000: 0 chip ≤ $T_{UE-GPSj}$ < 0.125 chip GPS_TIME_00000000000001: 0.125 chip ≤ $T_{UE-GPSj}$ < 0.250 chip GPS_TIME_00000000000002: 0.250 chip ≤ $T_{UE-GPSj}$ < 0.375 chip ... GPS_TIME_18554879999997: 2319359999999.625 chip ≤ $T_{UE-GPSj}$ < 2319359999999.750 chip GPS_TIME_18554879999998: 2319359999999.750 chip ≤ $T_{UE-GPSj}$ < 2319359999999.875 chip GPS_TIME_18554879999999: 2319359999999.875 chip ≤ $T_{UE-GPSj}$ < 2319360000000.000 chip

5.2 UTRAN measurement abilities

The structure of the table defining a UTRAN measurement quantity is shown below.

Column field	Comment
Definition	Contains the definition of the measurement.
Range/mapping	Gives the range and mapping to bits for the measurements quantity.

5.2.1 RSSI

Definition	Received Signal Strength Indicator, the wide-band received power within the UTRAN uplink carrier channel bandwidth in an UTRAN access point. The reference point for the RSSI measurements shall be the antenna connector.
Range/mapping	RSSI is given with a resolution of 0.1 dB with the range [-112, ..., -50] dBm. RSSI shall be reported in the unit RSSI_LEV where: RSSI_LEV _000: RSSI < -112.0 dBm RSSI_LEV _001: -112.0 dBm ≤ RSSI < -111.9 dBm RSSI_LEV _002: -111.9 dBm ≤ RSSI < -111.8 dBm ... RSSI_LEV _619: -50.2 dBm ≤ RSSI < -50.1 dBm RSSI_LEV _620: -50.1 dBm ≤ RSSI < -50.0 dBm RSSI_LEV _621: -50.0 dBm ≤ RSSI

5.2.2 SIR

Definition	Signal to Interference Ratio, is defined as: (RSCP/ISCP)×SF. Measurement shall be performed on the DPCCH after RL combination in Node B. The reference point for the SIR measurements shall be the antenna connector. where: RSCP = Received Signal Code Power, the received power on one code. ISCP = Interference Signal Code Power, the interference on the received signal. Only the non-orthogonal part of the interference is included in the measurement. SF=The spreading factor used on the DPCCH.
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 < –11.0 dB UTRAN_SIR_01: -11.0 dB ≤ SIR < –10.5 dB UTRAN_SIR_02: -10.5 dB ≤ SIR < –10.0 dB ... UTRAN_SIR_61: 19.0 dB ≤ SIR < 19.5 dB UTRAN_SIR_62: 19.5 dB ≤ SIR < 20.0 dB UTRAN_SIR_63: 20.0 dB ≤ SIR

5.2.3 Transmitted carrier power

Definition	Transmitted carrier power, is the ratio between the total transmitted power and the maximum transmission power. Total transmission power is the mean power [W] on one carrier from one UTRAN access point. Maximum transmission power is the mean power [W] on one carrier from one UTRAN access point when transmitting at the configured maximum power for the cell. 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 %-unit 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 %

5.2.4 Transmitted code power

Definition	Transmitted code power, is the transmitted power on one channelisation code on one given scrambling code on one given carrier. Measurement shall be possible on any DPCH transmitted from the UTRAN access point and shall reflect the power on the pilot bits of the DPCH. The reference point for the transmitted code power measurement shall be the antenna connector. In case of Tx diversity the transmitted code power for each branch shall be measured.
Range/mapping	Transmitted code power is given with a resolution of 0.5 dB with the range [-10, ..., 46] dBm. Transmitted code power shall be reported in the unit UTRAN_CODE_POWER where: UTRAN_CODE_POWER _010: -10.0 dBm ≤ Transmitted code power < -9.5 dBm UTRAN_CODE_POWER _011: -9.5 dBm ≤ Transmitted code power < -9.0 dBm UTRAN_CODE_POWER _012: -9.0 dBm ≤ Transmitted code power < -8.5 dBm ... UTRAN_CODE_POWER _120: 45.0 dBm ≤ Transmitted code power < 45.5 dBm UTRAN_CODE_POWER _121: 45.5 dBm ≤ Transmitted code power < 46.0 dBm UTRAN_CODE_POWER _122: 46.0 dBm ≤ Transmitted code power < 46.5 dBm

5.2.5 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. Measurement shall be possible to perform on any transport channel after RL combination in Node B. BLER estimation is only required for transport channels containing CRC.
Range/mapping	The Transport channel BLER shall be reported for 0 ≤ Transport channel BLER ≤ 1 in the unit BLER_LOG where: BLER_LOG_00: Transport channel BLER = 0 BLER_LOG_01: -∞ < Log10(Transport channel BLER) < -4.03 BLER_LOG_02: -4.03 ≤ Log10(Transport channel BLER) < -3.965 BLER_LOG_03: -3.965 ≤ Log10(Transport channel BLER) < -3.9 ... BLER_LOG_61: -0.195 ≤ Log10(Transport channel BLER) < -0.13 BLER_LOG_62: -0.13 ≤ Log10(Transport channel BLER) < -0.065 BLER_LOG_63: -0.065 ≤ Log10(Transport channel BLER) ≤ 0

5.2.6 Transport channel BER

Definition	The transport channel BER is an estimation of the average bit error rate (BER)) of RL-combined DPDCH 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	The Transport channel BER shall be reported for 0 ≤ Transport channel BER ≤ 1 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) < -0.08125 TrCh_BER_LOG_255: -0.008125 ≤ Log10(Transport channel BER) ≤ 0

5.2.7 Physical channel BER

Definition	The Physical channel BER is an estimation of the average bit error rate (BER) on the DPCCH after RL combination in Node B. An estimate of the Physical channel BER shall be possible to be reported after the end of each TTI of any of the transferred TrCHs. The reported physical channel BER shall be an estimate of the BER during the latest TTI.
Range/mapping	The physical channel BER shall be reported for 0 ≤ Physical channel BER ≤ 1 in the unit PhCh_BER_LOG where: PhCh_BER_LOG_000: Physical channel BER = 0 PhCh_BER_LOG_001: -∞ < Log10(Physical channel BER) < -2.06375 PhCh_BER_LOG_002: -2.06375≤ Log10(Physical channel BER) < -2.055625 PhCh_BER_LOG_003: -2.055625 ≤ Log10(Physical channel BER) < -2.0475 ... PhCh_BER_LOG_253: -0.024375 ≤ Log10(Physical channel BER) < -0.01625 PhCh_BER_LOG_254: -0.01625 ≤ Log10(Physical channel BER) < -0.008125 PhCh_BER_LOG_255: -0.008125 ≤ Log10(Physical channel BER) ≤ 0

5.2.8 Round trip time

Definition	Round trip time (RTT), is defined as RTT = $T_{RX} – T_{TX}$, 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. Measurement shall be possible on DPCH for each RL transmitted from an UTRAN access point and DPDCH/DPCCH for each RL received in the same UTRAN access point.
Range/mapping	The Round trip time is given with the resolution of 0.25 chip with the range [876, …, 2923.50] chips. The Round trip time shall be reported in the unit RT_TIME where: RT_TIME_0000: Round trip time < 876.00 chip RT_TIME_0001: 876.00 chip ≤ Round trip time < 876.25 chip RT_TIME_0002: 876.25 chip ≤ Round trip time < 876.50 chip RT_TIME_0003: 876.50 chip ≤ Round trip time < 876.75 chip ... RT_TIME_8188: 2922.75 chip ≤ Round trip time < 2923.00 chip RT_TIME_8189: 2923.00 chip ≤ Round trip time < 2923.25 chip RT_TIME_8190: 2923.25 chip ≤ Round trip time < 2923.50 chip RT_TIME_8191: 2923.50 chip ≤ Round trip time

5.2.9 UTRAN GPS Timing of Cell Frames for LCS

Definition	The timing between cell j and GPS Time Of Week. $T_{UTRAN-GPSj}$ is defined as the time of occurrence of a specified UTRAN event according to GPS time. The specified UTRAN event is the beginning of a particular frame (identified through its SFN) in the first significant multipath of the cell j CPICH, where cell j is a cell within the active set.
Applicable for	Connected Intra, Connected Inter
Range/mapping	The resolution of $T_{UTRAN-GPSj}$ is 0.125 chips. The range is from 0 to 2319360000000 chips. $T_{UTRAN-GPSj}$ shall be reported in the unit GPS_TIME where: GPS_TIME_00000000000000: 0 chip ≤ $T_{UTRAN-GPSj}$ < 0.125 chip GPS_TIME_00000000000001: 0.125 chip ≤ $T_{UTRAN-GPSj}$ < 0.250 chip GPS_TIME_00000000000002: 0.250 chip ≤ $T_{UTRAN-GPSj}$ < 0.375 chip ... GPS_TIME_18554879999997: 2319359999999.625 chip ≤ $T_{UTRAN-GPSj}$ < 2319359999999.750 chip GPS_TIME_18554879999998: 2319359999999.750 chip ≤ $T_{UTRAN-GPSj}$ < 2319359999999.875 chip GPS_TIME_18554879999999: 2319359999999.875 chip ≤ $T_{UTRAN-GPSj}$ < 2319360000000.000 chip

5.2.10 Propagation delay

Definition	Propagation delay is defined as one-way propagation delay as measured during PRACH access: Propagation delay = (T_{RX} – T_{TX} – 2560)/2, where: T_{TX} = The time of AICH access slot (n-2-AICH transmission timing), where 0≤(n-2-AICH Transmission Timing)≤14 and AICH_Transmission_Timing can have values 0 or 1. T_{RX} = The time of reception of the beginning (the first significant path) of the PRACH message from the UE at PRACH access slot n. Note: The definition of "first significant path" needs further elaboration.
Range/mapping	The Propagation delay is given with the resolution of 3 chips with the range [0, …, 765] chips. The Propagation delay shall be reported in the unit PROP_DELAY where: PROP_DELAY_000: 0 chip ≤ Propagation delay < 3 chip PROP_DELAY_001: 3 chip ≤ Propagation delay < 6 chip PROP_DELAY_002: 6 chip ≤ Propagation delay < 9 chip ... PROP_DELAY_252: 756 chip ≤ Propagation delay < 759 chip PROP_DELAY_253: 759 chip ≤ Propagation delay < 762 chip PROP_DELAY_254: 762 chip ≤ Propagation delay < 765 chip PROP_DELAY_255: 765 chip ≤ Propagation delay

6 Measurements for UTRA FDD

6.1 UE measurements

6.1.1 Compressed mode

6.1.1.1 Use of compressed mode/dual receiver for monitoring

A UE shall, on higher layers commands, monitor cells on other frequencies (FDD, TDD, GSM). To allow the UE to perform measurements, higher 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.

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.

Monitoring frequencies outside TDD and GSM 1800/1900 bands without uplink compressed mode is a UE capability.

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 UE shall support one single measurement purpose within one compressed mode transmission gap. The measurement purpose of the gap is signalled by higher layers.

The following subclause provides rules to parametrise the compressed mode.

6.1.1.2 Parameterisation of the compressed mode

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

A transmission gap pattern sequence consists of alternating transmission gap patterns 1 and 2, each of these patterns in turn consists of one or two transmission gaps. See figure 1.

The following parameters characterize a transmission gap pattern:

- TGSN (Transmission Gap Starting Slot Number): A transmission gap pattern begins in a radio frame, henceforward called first radio frame of the transmission gap pattern, containing at least one transmission gap slot. TGSN is the slot number of the first transmission gap slot within the first radio frame of the transmission gap pattern;
- TGL1 (Transmission Gap Length 1): This is the duration of the first transmission gap within the transmission gap pattern, expressed in number of slots;
- TGL2 (Transmission Gap Length 2): This is the duration of the second transmission gap within the transmission gap pattern, expressed in number of slots. If this parameter is not explicitly set by higher layers, then TGL2 = TGL1;
- TGD (Transmission Gap start Distance): This is the duration between the starting slots of two consecutive transmission gaps within a transmission gap pattern, expressed in number of slots. The resulting position of the second transmission gap within its radio frame(s) shall comply with the limitations of [2]. If this parameter is not set by higher layers, then there is only one transmission gap in the transmission gap pattern;
- TGPL1 (Transmission Gap Pattern Length): This is the duration of transmission gap pattern 1;
- TGPL2 (Transmission Gap Pattern Length): This is the duration of transmission gap pattern 2. If this parameter is not explicitly set by higher layers, then TGPL2 = TGPL1.

The following parameters control the transmission gap pattern sequence start and repetition:

- TGPRC (Transmission Gap Pattern Repetition Count): This is the number of transmission gap patterns within the transmission gap pattern sequence;
- TGCFN (Transmission Gap Connection Frame Number): This is the CFN of the first radio frame of the first pattern 1 within the transmission gap pattern sequence.

In addition to the parameters defining the positions of transmission gaps, each transmission gap pattern sequence is characterized by:

- UL/DL compressed mode selection: This parameter specifies whether compressed mode is used in UL only, DL only or both UL and DL;
- UL compressed mode method: The methods for generating the uplink compressed mode gap are spreading factor division by two or higher layer scheduling and are described in [2];
- DL compressed mode method: The methods for generating the downlink compressed mode gap are puncturing, spreading factor division by two or higher layer scheduling and are described in [2];
- downlink frame type: This parameter defines if frame structure type 'A' or 'B' shall be used in downlink compressed mode. The frame structures are defined in [2];
- scrambling code change: This parameter indicates whether the alternative scrambling code is used for compressed mode method 'SF/2'. Alternative scrambling codes are described in [3];
- RPP: Recovery Period Power control mode specifies the uplink power control algorithm applied during recovery period after each transmission gap in compressed mode. RPP can take 2 values (0 or 1). The different power control modes are described in [4];
- ITP: Initial Transmit Power mode selects the uplink power control method to calculate the initial transmit power after the gap. ITP can take two values (0 or 1) and is described in [4].

The UE shall support [8] simultaneous compressed mode pattern sequences which can be used for different measurements.

Higher layers will ensure that the compressed mode gaps do not overlap and are not scheduled to overlap the same frame. The behaviour when an overlap occurs is described in TS 25.302.

In all cases, higher layers have control of individual UE parameters. Any pattern sequence can be stopped on higher layers' command.

The parameters TGSN, TGL1, TGL2, TGD, TGPL1, TGPL2, TGPRC and TGCFN shall all be integers.

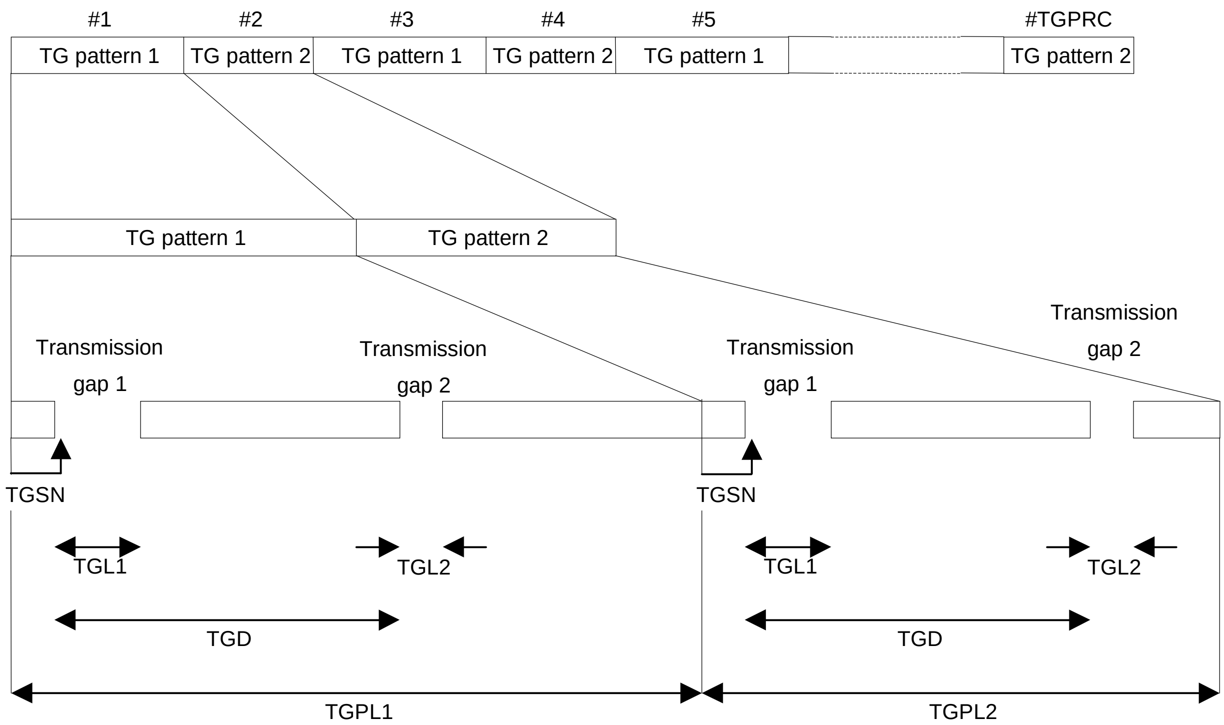

Figure 1: Illustration of compressed mode pattern parameters

6.1.1.3 Parameterisation limitations

In the table below the supported values for the TGL1 and TGL2 parameters are shown.

Measurements performed on	Supported TGL1 values, when TGL2 is not set	Supported TGL1 and TGL2 values when both are set (TGL1, TGL2)
FDD inter-frequency cell	7, 14	(10, 5)
TDD cell	4	-
GSM cell	3, 4, 7, 10, 14	-

Multi-mode terminals shall support all TGL1 and TGL2 values for the supported modes.

Further limitations on the transmission gap position within its frame(s) are given in TS 25.212.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
14/01/00	RAN_05	RP-99590	-		Approved at TSG RAN #5 and placed under Change Control	-	3.0.0
14/01/00	RAN_06	RP-99688	001	3	Clarifications for compressed mode parameters	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	002	-	Definition of PCCPCH RSCP	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	003	-	Definition of observed time difference to GSM cell	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	004	-	Measurements are done on Primary CPICH	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	005	1	Physical channel BER on DPCCH	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	006	-	Definition of SIR measurement	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	007	2	Ranges and resolution of timing measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	009	2	Range and resolution for RF related measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99689	010	2	New subclauses: 5.1.15 - UE GPS Timing of Cell Frames for LCS; 5.2.8 UTRAN GPS Timing of Cell Frames for LCS	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	011	-	Removal of Annex A from TS 25.215	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	013	-	Definition of Transmitted code power	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	014	2	Range and resolution of BLER measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	015	2	Range and resolution of BER measurements	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	020	-	Correction of SFN-SFN observed time difference	3.0.0	3.1.0
14/01/00	RAN_06	RP-99688	021	1	CFN-SFN measurement with compressed mode	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-000066	024	1	Definition of Transmitted carrier power	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	025	-	Clarification of Observed time difference to GSM cell	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	027	-	Naming of BER/BLER mapping	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	028	-	Minor corrections in TS 25.215	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	029	-	Re-definition of timing measurements	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	030	2	Mapping of timing measurements	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	031	-	Removal of note in Round trip time measurement	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	033	-	Removal of fixed gap position in 25.215	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	036	4	Corrections to 25.215 compressed mode parameter list	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	037	3	Definition and range of physical channel BER	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	040	-	Clarification of CPICH measurements in Tx diversity	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	042	1	UTRAN RSSI measurement	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	043	1	UTRAN Propagation delay	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	044	2	Correction to subclauses: 5.1.15 UE GPS Timing of Cell Frames for LCS; 5.2.8 UTRAN GPS Timing of Cell Frames for LCS, including timing mapping	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	047	-	Removal of RSCP measurement	3.1.1	3.2.0
31/03/00	RAN_07	RP-000066	048	-	UE BER measurement removal and clarification for use of uplink compressed mode	3.1.1	3.2.0

History

Document history		
V3.2.0	March 2000	Publication